Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

✓ 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 **basic buffer** solution resist change in pH on the addition of small amount of acid or base? **An acidic** buffer solution of pH 4.8 has to be prepared from acetic acid of 2N and sodium acetate. What amount of sodium acetate should be added to 1L of acetic acid? Where, pKa for acetic is 4.74. [2+3]

2. a) What is **meant by** single electrode potential? How does it originate? What are the factors affecting the single electrode? [1+1+1]

   b) Calculate the emf for the following cell at 25°C, [2]

   $Sn(s)/Sn^{2+}(0.15M)//Ag^{+}(0.03M)/Ag(s)$, Where $E^{0}Sn^{2+}/Sn = -0.14V$ &

   $E^{0}Ag^{+}/Ag = +0.80V$

3. What are inhibitors? Describe the intermediate compound formation theory of catalysis with a suitable example. Point out criteria of catalysts used for industrial purpose. [1+3+1]

4. What are different **water** pollutants? Mention the different sources of water pollution, their adverse effects and possible remedies. [1+2+1+1]

5. a) How is ozone formed and depleted in nature? What are the consequences of depletion of ozone layer in the atmosphere? [2+1]

   b) Describe the adverse effects of air pollutants and their possible remedies. [2]

6. What is biodegradable polymer? Mention preparations and use of the following. [1+2+2]

   i) Polyurethane
   ii) Nylon-6,6

7. What is conducting polymer? Give the preparation and applications of: [1+2+2]

   i) Polyphosphazenes
   ii) Polymeric Sulphure nitride $(SN)_n$

8. Explain the following features of transition elements with reference to 3-d transition series (i) Alloy formation (ii) Complex formation. [2.5+2.5]

9. Write the possible oxidation states of Sc and Cr [1+2+2]

   i) $TiCl_3$ is colored compound but $TiCl_4$ is colorless compound. Explain
   ii) $K_4[Fe(CN)_6]$ is diamagnetic compound but $K_3[Fe(CN)_6]$ is paramagnetic. Explain

10. Show your familiarity with double salt, complex salts and ligands. How does Werner's theory explain the structure of complex compounds? [3+2]

11. a) Using valence bond theory, predict the geometry and magnetic properties of $[Ni(CN)_4]^{2-}$ and $[Co(NH_3)_6]^{2+}$ [1.5+1.5]

b) Write the IUPAC names of the following co-ordination compounds. [2]

i) $[Na_3[Al(C_2O_4)_3]]$

ii) $[Co(NH_3)_2(en)_2]Cl_3$

iii) $K_3[Fe(C_2O_4)_3]$

iv) $[Al(OH)(H_2O)_5]^{2+}$

12. What are explosives? Classify the explosives with respect to sensitivity. What are the impurities that you expect in crude product of TNT? [1+2+2]

13. a) What are the requisites of good paints? Write about enamels. [2.5]

b) What is meant by lubricant? Write about semi solid lubricants and their uses. [2.5]

14. a) What are geometrical isomers? Show your familiarity with E and Z configuration with suitable examples. [1+2]

b) Define Cis and trans isomers. Why is trans isomer more stable than Cis isomer? [2]

15. Define enantiomers, diasteromers, racemic mixture and meso compound with a suitable example of each. Also write their optical activity. [5]

16. Give an account of SN reactions. Explain the reaction mechanism for the reaction between 3°alkyl halide and aqueous NaOH. [2+3]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

✓ 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 an electrochemical series? How does an electrolytic cell differ from a galvanic cell? Calculate the emf of the following cell at 25°C   [1+2+2]

    $Zn/Zn^{++}(0.1M)//Cu^{++}(0.05M)/Cu$

    Given, $E^0Zn^{++}/Zn = -0.76V. E^0Cu^{++}/Cu = 0.34V$

2. a) How does an acidic buffer solution containing acetic acid and sodium acetate resist the change in p^H in in spite of the addition of the small amount of acid or base? Explain it.   [2]

    b) Calculate the pH of resulting solution when 0.01 mole of NaOH is added to 500ml of 0.1M acetic acetic acid (p^{ka} for acetic is 4.74)   [3]

3. What is homogeneous catalyst? How does a catalyst alter the rate of reaction? Explain with example.   [1+4]

4. What is water pollution? Write down the major sources of water pollution and mention the possible measure to control. How does the oxides nitrogen make the water acidic?   [1+3+1]

5. Write short notes on: [2.5+2.5]

    i) Ozone layer depletion
    ii) Global warming due to air pollution

6. What is conducting polymer? Describe the preparation and uses of polyurethane and Epoxy resin.   [1+2+2]

7. a) Write down the structure of cyclic and cross linked silicones and also give the engineering applications of silicones.   [1+1]

    b) What are the general characteristic of inorganic polymer? Write the preparation and uses of polymeric sulphur.   [1+2]

8. Give reasons: [5]

    a) Transition elements are mostly paramagnetic
    b) Transition elements and their compounds show catalytic behavior
    c) $Fe_2(SO_4)_3$ is more stable then $FeSO_4$
    d) Compound of Ti^{+3} are coloured but those if Ti^{+4} are colourless
    e) Zn in 3d series is called typical transition element

9. Write the expected and actual electronic configuration of Cr in box notation. Why the actual electronic configuration of Cr is different from expected electronic configuration? In the 3-d transition series the size of atom decreases from Sc to Cr but the size remains almost similar from Cr to Zn. Explain.   [1+1+1+2]

10. How does valence bond theory explain the geometry and magnetic behavior of a complex? Explain with suitable example.   [5]

11. a) Explain the formation of $[FeF_6]^{3-}$ on the basis of VBT and predict its geometry as well as magnetism.   [3]

    b) Write IUPAC names of the given examples.   [2]

    i) $[Ni(CO)_4]$

    ii) $K_4[Fe(CN)_6]$

    iii) $Na[Ag(CN)_2]$
    iv) $K_2[HgI_4]$

12. What primary explosives, low explosives and high explosives? Write the preparation and uses of nitroglycerine.   [3+2]

13. a) What is lubricant? In what situation grease and solid lubricant are used?   [1+2]

    b) What are the characteristics of good paints?   [2]

14. Explain enantiomers, racemic mixture and meso compounds with examples. Draw the structures and specify Z and E configuration of 4-methyl hept 3-ene and 2-chlori pent 2-ene.   [3+2]

15. Describe the bimolecular nuclephilic substitution reaction in haloalkane with suitable example. What type of solvent is favour for this reaction? Write down the differences between S_{N_1} and S_{N_2} reactions?   [2+1+2]

16. Explain the reaction mechanism of dehydrohalogenation of tertiary butyl bromide by alcoholic caustic soda. Mention the factors governing the mechanism of E1 reaction.   [3+2]

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

✓ 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 Normal Hydrogen Electrode? Discuss its use to measure standard electrode potential of copper electrode. Calculate Emf of the following cell at 20°C.

   $Al(s) / Al^{+3}(0.2M) // Cu^{+2}(0.1M) / Cu(s)$
   Given: $E^0_{Al/Al^{+3}} = +1.66V$ and $E^0_{Cu/Cu^{+2}} = -0.34$ V   [1+1.5+2.5]

2. What is meant by 'buffer solution' and buffer action? A litre of solution containing 0.5 mole of CH_3COOH and 0.5 mole of CH_3COONa provides a buffer of pH 4.74. Calculate the pH of solution after the addition of 0.02 mole NaOH [$K_a = 1.8 \times 10^{-5}$]   [2+3]

3. Define Heterogenous catalysis. What are the general characteristics of a catalyst? Explain adsorption theory of catalysis.   [1+2+2]

4. Write short notes on: [2.5+2.5]

   a) Global warming   b) Acid Rain

5. What is soil pollution? Point out major soil pollutants, their effects and possible remedies?   [1+4]

6. a) Why do the transition elements form complexes?   [2.5]

   b) Why do the transition metals exhibit variable valency?   [2.5]

7. a) What are transition elements? Which of the d-block elements are not considered as typical elements and why?   [1+2]

   b) Write the electronic configuration and group of the following elements Cr, Fe, Cu and Zn.   [2]

8. $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$, both are octahedral complexes. Explain the difference between these two complexes on the basis of VBT.   [5]

9. a) How do you distinct a double salt from a complex salt?

   b) Write the IUPAC names of the following co-ordination compounds.

     (i) $[Co(H_2O)_2(OH)_4]^-$ (ii) $[Ni(CN)_4]^{2-}$

     (iii) $K_3[Al(C_2O_4)_3]$ (vi) $[Cu(NH_3)_4]SO_4$ [3+2]

10. Define the following terms with example.   [1×5]

    a) pigment   b) thinner   c) solid lubricant   d) varnishes   e) lacquers

11. Write the differences between organic and inorganic polymers. Write the preparation and applications of polyphosphazines.   [2+3]

12. Write the method of preparation and two important uses of Bakelite and polyurethane. [2.5+2.5]

13. Write preparation and two important uses of

    a) TNT   b) TNG   [2.5+2.5]

14. How do enantiomers differ from diasteromers? Write all the possible stereoisomers of a compound that contain two asymmetric carbon atoms.   [3+2]

15. What is elimination reaction? Explain the reaction mechanism for the dehydrohalogenation of primary alkyl halide.   [1+4]

16. What are the factors affecting S_N^1 and S_N^2 reactions. Explain SN^2 reaction mechanism with reference to hydrolysis of alkyl halide.   [2.5+2.5]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

✓ 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 salt bridge? Write its functions. Write electrode reaction, net cell reaction, EMF of the cell at 25°C and cell notation of the following electrode couple and also predict the spontaneity of the cell reaction. [1+1+3]

$E^0Fe/Fe^{++} = 0.44V$, $E^0Ag/Ag^+ = -0.80V$

$[Fe^{++}] = 0.01M$, $[Ag^+] = 0.1M$

2. What is buffer capacity? Write the characteristics of buffer solution. 200 ml of 0.1M C_6H_5 COONa is mixed with 400 ml of 0.2 M C_6H_5COOHa at 30°C dilute solution. Calculate the pH of solution. [1+2+2]

3. Explain the terms: (a) Acetocatalyst (b) Catalytic poisoining and (c) Promoters. [2+3]

4. Explain the mechanism of ozone layer depletion. Write its preventive measures and secondary pollution effects in troposphere. [2+1.5+1.5]

5. Define soil pollution. Write the major sources of soil pollution, their negative effects and control measures. [1+2+2]

6. Write short notes on: [2.5×2]

   i) Polyphosphazine
   ii) Chalcogenide glasses

7. a) Give an account for biodegradable and non biodegradable polymer with suitable example.

   b) What are fibers reinforced plastics? Write down the characteristics and its application.[2.5+2.5]

8. What are transition elements? How do they show: (i) catalytic behaviour (ii) coloured ions and (iii) variable oxidation states? [0.5+1.5+1.5+1.5]

9. Explain the formation of $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{-2}$ on the basic of VBT of coordination compounds. [2.5×2]

10. a) Write the formula of the following IUPAC name: [2]

   i) Potassium penta cyano nytrosyl ferate (III)
   ii) Pentaammine chloro cabalt (III) ion
   iii) Tetracarbonyl cabalt (O)
   iv) Pentamminenitrito cobalt (III) sulphate

   b) "$[Fe(CN)_6]^{4-}$ is diamagnetic but $[Fe(CN)_6]^{3-}$ is paramagnetic" justify. [1.5+1.5]

11. What are lubricants? What are the characters of good lubricants? What is emulsm paint? Write its applications? [1+2+1+1]

12. Define explosive. How it is used for defense purpose? What are the uses of TNT, TNG and cellulose nitrate? [1+1+1+1+1]

13. What are geometrical isomers? Geometrical isomer is not possible in the compound $CH_3CH = CH_2$ explain. Why are trans isomers more stable than Tis-isomers? [1+2+2]

14. What is a nucleophilic substitution reaction? Differentiate between SN^2 and SN^1 reactions. Write the factors affecting SN^2 and SN^1 reactions. [1+2+2]

15. Explain reaction mechanism for dehydrohalogenation of tertiary butyl bromide. What solvent favours the reaction mechanism? [4+1]

16. Write ground state electronic configuration of 3d transition series. How do you explain the formation of complexes by 3d transition elements? [2+3]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry (SH403)

✓ 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 buffer solution? Derive Henderson's equation for basic buffer. Calculate pH of a mixture of 10 ml of 0.1M ammonium chloride solution and same volume of 0.2 M ammonia solution. (pKb for ammonia solution = 4.74). [1+1+3]

2. How does a galvanic cell generate electricity? Construct a cell with the following cell reaction, write its notation and calculate standard emf of the cell. [1+1+1+2]
$2Al + 3Z_nSO_4 \rightarrow Al_2(SO_4)_3 + Z_n$ at 298K
   (1M)   (1M)
   Given, standard reduction potential of Al and Zn are -1.66V and 0.76 V respectively.

3. What is catalysis? Explain intermediate compound formation theory and an industrial application of catalysis. [1+2.5+1.5]

4. What are the parameters of water pollution? Explain its causes and adverse effects. [3+1+1]

5. Write the functions of lubricant. Show your acquaintance with fluid film lubrication and its role in engineering. Give an example each of (a) semi solid lubricant and (b) emulsion.[1+2+1+1]

6. Write short notes on: (any two) [2.5+2.5]
   i)   Global warming
   ii) Formation and depletion of ozone layer
   iii) Acid rain and its effects

7. What is conducting polymer? Give an account of polyphosphazines and chalcogenide galsses. Also write their applications in engineering field. [1+2+2]

8. Explain the following: [2+3]
   i)   3d- transition series show variable axidation states
   ii) Completely filled 3-d transition series are unable to form coloured compounds

9. What is a complex ion? Give example of a (i) complex cation and (ii) complex anion, with their IUPAC name. Also calculate EAN of central metal of these ions. [1+1+1+1+1]

10. Show your acquaintance on the basis of hydbridisation with inner orbital and outer orbital complexes with example. [2.5+2.5]

11. Differentiate between high explosive and low explosives. Write the preparation and applications of TNT. [3+2]

12. Write the method of preparation and uses of (a) polystyrene (b) Bakelite [2.5+2.5]

13. Distinguish between enantiomers and diastereomers. Show all optical isomers of (a) 3-Bromo 2-butanol and (b) Tartaric acid. Also show optically inactive meso form of tartaric acid. Explain why 3-Bromo 2-butanol doesn't exist in meso form. [1+1.5+1+1+0.5]

14. Explain E_2 and E_1 reactions with referance to dehydrohalogenation of haloalkane and point out the factors affecting these mechanism. [1.5+1.5+2]

15. Why does haloalkane favour S_N reaction? Explain why there is only inversion product in S_N2 and both inversion and retention products in S_N1 path. [1+2+2]

16. What is plastic explosive? Write preparation and uses of Cellos

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

✓ 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*.
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1. Derive Henderson equation for buffer solution. What is the pH of resulting mixture obtained by mixing of 100 cc of 0.2 N HCL and 50 cc of 0.5M ammonia solution, K_b for ammonia is 1.8×10^{-4}.   [1+4]

2. How can you measure the standard reduction potential of Zn electrode? Hydrogen electrode at 1 atm is connected with Zn electrode in which the emf of the cell is found to be 0.61 V at 25°C. If $[Zn^{++}] = 1.0$ M, calculate H^+ in hydrogen electrode.   [2+3]

3. What is heterogeneous catalysis? Giving a suitable example, explain the mechanism of heterogeneous catalysis. Write any two criteria for choosing a catalyst for industrial purpose.   [1+3+1]

4. a) What do you mean by CFC? Mention their photolytic reactions in high altitude at stratosphere.

   b) How do the oxides of sulphur and nitrogen make water acidic?   [1+2+2]

5. Write major sources of water pollution. How does CO_2 act as pollutant of the atmosphere? Explain.   [[2+3]

6. Give an account on chalcogenide glasses and polysulphur nitride.   [2.5+2.5]

7. Explain about the biodegradable and non-biodegradable polymers with suitable examples.[2.5×2]

8. Explain giving reasons.

   a) Transition metals and their compounds show paramagnetic behavior.   [2.5]

   b) Zinc (I I) Compounds are white and diamagnetic while copper (I I) Compounds are colored and paramagnetic.   [2.5]

9. Transition elements formed colored compounds. Explain this on the basis of d to d transition.   [5]

10. Compare the magnetic behavior of the complex entities $[Fe(CN)_6]^{4-}$ and $[FeF_6]^{3-}$ using valence bond theory.   [2.5+2.5]

11. a) Write the IUPAC name of the following co-ordination compounds.   [2]

    i) $[Cr(NH_3)_6]^{3+}$

    ii) $[Pt (NH_3)_2Cl_2]$

    iii) $Na_3 [Cr (C_2 O_4)_3]$

    iv) $[CO (NH_3)_4 Cl_2] Cl$

    b) What is EAN? How would you explain the stability and magnetic behavior of a complex compound by EAN rule.   [3]

12. a) Write the characteristics of a good paint and explain the method of application of paint in galvanized iron.

b) Mention the types and functions of lubricants with examples. [2+1+2]

13. a) What isomerism is shown by lactic acid? Write its possible isomers. [2]

b) What do you mean by racemic mixture? Explain chemical resolution of a racemic mixture. [1+2]

14. a) Describe SN^1 reaction mechanism in haloalkane shown stereochemistry.

b) Why does nucleophile attack the substrate molecule from backside in SN^2 reaction mechanism? [4+1]

15. Discuss E^1 reaction with reference to the dehydrohalogenation of alkyl halide. How does E^1 differs from E^2 reaction. [3+2]

16. What are plastic explosives? Write down the characteristics of explosives. Give the preparation and uses of explosive obtained from toluene. [1+2+2]

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06   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chitra

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Chemistry *(EG403SH)*

✓ 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) What are the limitations of Bohr's atomic theory? [4]

   b) State and explain Hund's rule of maximum multiplicity. [4]

2. a) Define a buffer solution. Explain the mechanism of a buffer action. [2+3]

   b) What is the pH of a buffer solution having 0.20M acetic acid and 0.1M sodium acetate, k_a for acetic acid is 1.8×10^{-5}? [3]

3. a) How does a galvanic cell differ from an electrolytic cell? [3]

   b) Define standard electrode potential. [1]
   Calculate the emf of the following cell at 25°C. [4]
   $$Zn/Zn^{++} (0.025M) // Cu^{++} (0.1M)/Cu$$

   $$E^0 Zn^{++}/_{Zn}= - 0.76V, \qquad E^0Cu^{++}/Cu = 0.34V$$

4. a) Derive an expression for the work done in an isothermal reversible expansion of an ideal gas. [4]

   b) How is C_p of a gas related to C_v? [4]

OR

[2x4]

Write shot notes on

a) Hess's law of constant heat summation

b) Calorific value of food and fuel

Group B

5. a) How does Werner's theory explain the structure of coordination compounds? [4]

   b) Write the formula of following; [4]

   i) Triamminechlorocyanonitrocobalt(III)
   ii) Diamminesilver(I) chloride
   iii) Potassium hexacyanoferrate(III)
   iv) Pentaamminechlorocobalt(III) ion

OR

b. What are complex salts and double salts? [4]

c. Explain the geometry and magnetic property of $[Fe (CN)_6]^{--}$ on the basis of valence bond theory. [4]

6. a) Explain the geometry of PCl_5 on the basis of hybridization. [6]

b) Explain the formation of O_2 on the basis of valence bond theory. [2]

7. a) What are transition elements? Briefly discuss any two features of transition elements. [6]

b) Give the uses of silicones. [2]

Group C

8. Explain SN_1 and SN_2 reaction mechanism briefly. [4+4]

OR,

a) Briefly discuss E_1 reaction mechanism with appropriate example. [4]

b) Show your familiarity with Pinacol Pinacolone rearrangement. [4]

9. a) What are geometrical isomers? [2]

b) Define enantiomers and diastereomers with suitable examples. [3+3]

10. a) Give the preparation and uses of bakelite or Nylon-66. [4]

b) List the uses of explosives. Give the preparation of trinitrotoluene (TNT). [1+3]

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Level	BE	Full Marks	80
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Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry (SH403)

✓ 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 a galvanic cell. What are functions of salt bridge in a galvanic cell? Predict the feasibility of the following reactions,

   i) $Zn + Ag^+ \rightarrow Zn^{++} + Ag$
   ii) $Zn^{++} + Ag \rightarrow Zn + Ag^+$
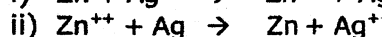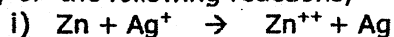
   Given, $E^0{}_{Zn^{++}/Zn} = -0.76V$, $E^0{}_{Ag^+/Ag} = 0.80V$ [1+1+3]

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.   [1+1+3]

4. a) Point out the sources of radioactive substances responsible for environmental pollution. Give their adverse effects and protective measures.   [2.5]

   b) Briefly discuss any two sources of organic and inorganic substances responsible for water pollution. Point out their possible remedies.   [2.5]

5. a) How do exhausts of internal combustion engine pollute air? Give the possible remedies.   [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 polystyrene and polyurethanes.   [4]

   b) What are the advantages of conducting polymers?   [1]

8. Why do transition elements form complexes? List the industrial application of 3d transition elements in engineering.   [3+2]

9. Explain the following features of transition elements with reference to 3d transition series;   [2.5+2.5]
   a) Variable oxidation state
   b) Formation of colored compounds

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

11. a) Write the IUPAC name of following; [2]
        i) $K_2[Hg\,I_4]$
        ii) $K_4[Fe(CN)_6]$
        iii) $[Co\,(NH_3)_5\,Cl]^{2-}$
        iv) $Li[AlH_4]$

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

12. What are primary explosives, low explosives and plastic explosives? Give the preparation and applications 2,4,6-Trinitrotoluene (TNT). [3+2]

13. a) Show your familiarity with liquid, semi solid and solid lubricants giving examples. [3]

   b) Discuss any two types of paints showing their applications in engineering works. [2]

14. a) What are geometrical isomers? Give an example. [2]

   b) Show your familiarity with diastereomerism. [2]

   c) Draw the structure of 2-Chlorobutane specifying R and S configuration. [1]

15. Discuss the unimolecular nucleophilic substitution reaction mechanism in alkyl halide showing the stereochemistry. [5]

16. What is meant by elimination reaction? Discuss E1 and E2 reaction mechanism. [1+4]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BME	Pass Marks	32
Year / Part	I / I	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 galvanic cell? Write electrode reaction, net cell reaction, EMF of the cell and cell notation of given electrode couple and also predict the spontaneity of the cell reaction.   [1+4]

   $E° Zn/Zn^{++} = 0.76V$, $E° Ag^{+}/Ag = 0.80V$
   $[Zn^{++}] = 0.01M$, $[Ag^{+}] = 0.1M$

2. How does an acidic buffer solution reserve its PH value on the addition of strong acid or strong base? 100ml of 0.2M CH_3COONa is mixed with 200ml of 0.3M CH_3COOH, which is 2.1% ionised in dilute solution. Find out the PH of the resulting solution.   [2.5+2.5]

3. Write the adsorption theory to describe the mechanism of heterogeneous catalysis with a suitable example. How does a promoter enhance the catalytic action? List any two criteria of catalysed reactions applicable for the industries.   [3+1+1]

4. Write short notes on:(any two)   [2.5+2.5]

   a) Green house effect
   b) Formation and depletion of ozone layer
   c) Acid rain

5. List out four major pollutants of air, their adverse effects on human health and also write their possible remedies.   [1+2+2]

6. Write the method of preparation and two important uses of each of polyurethane and diamine epoxy resin.   [2.5+2.5]

7. What is biodegradable polymer? Describe the contribution of carbon fibre reinforced polymer and chalcogenide glass in engineering.   [1+4]

8. a) What are transition elements? Which of the 3d series elements is not a transition element and why?   [1+2]

   b) Explain why compounds of V^{+5} are colourless but those of V^{+3} are colourful.   [2]

9. a) Explain the cause of origin of paramagnetism in transition elements.   [3]

   b) Explain why are transition elements good for alloy formation.   [2]

10. a) What is meant by effective atomic number of metal ion in the complex salt? What information does it convey?   [2]

    b) Explain the formation of $[Ni(CO)_4]°$ complex on the basis of VBT. Also predict its geometry and magnetism with reason.   [3]

11. a) Write the basic assumptions of Werner's theory of co-ordination compounds.   [3]

b) Write the IUPAC names of the following co-ordination compounds. [2]

    i) $[Co(NH_3)_2 (en)_2]Cl_3$

    ii) $[Al(OH) (H_2O)_5]^{2+}$

    iii) $K_4[Fe(CN)_6]$

    iv) $K[Ag(CN)_2]$
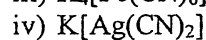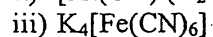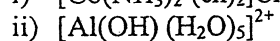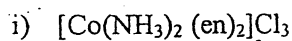
12. What is plastic explosive? How do you prepare dynamite and gun cotton? [1+2+2]

13. a) What is paint? Write characteristics of a good paint and explain the method of application of paint in galvanised iron. [0.5+1+1]
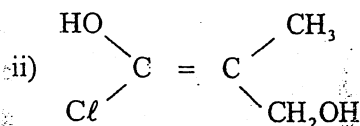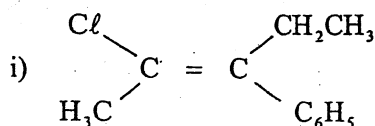
    b) What is lubricant? Give an example of emulsion and solid lubricant. Mention their specific functions. [0.5+1+1]

14. a) Distinguish between enantiomers and diasteromers. Write all possible stereoisomers of a compound that contain two asymmetric carbon atoms but cannot exist in meso forms. [4]

    b) Write the cis and trans isomers of butenedioic acid. [1]

15. a) What is resolution? Explain the method of chemical resolution of a racemate. [3]

    b) Determine E or Z configuration in the following molecules: [2]

i)

$$\underset{H_3C}{\overset{C\ell}{>}}C = C\underset{C_6H_5}{\overset{CH_2CH_3}{<}}$$

ii)

$$\underset{C\ell}{\overset{HO}{>}}C = C\underset{CH_2OH}{\overset{CH_3}{<}}$$

16. What is a nucleophlic substition reaction? Briefly explain SN^2 and SN^1 paths of such reaction in haloalkane. Mention the factors governing these paths. [1+2+2]

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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 electrode potential originate? Define standard electrode potential? Write the cell notation, and cell reaction for Zn-Cu cell. [2+1+2]

2. What is buffer solution? Calculate the pH of resulting solution when 0.005 mole of KOH is added to 200 ml of 0.1N acetic acid solution. (pK_a = 4.74). [1+4]

3. What is meant by homogeneous catalysis? Describe the intermediate compound formation theory of catalysis with a suitable example. List the criteria for choosing a catalyst for industrial application. [1+3+1]

4. a) What are chlorofluorocarbons? Give their photolytic reactions in the upper atmosphere. [3]

   b) Why oxides of sulphur and nitrogen are assumed as air pollutants? [2]

5. Point out four major pollutants of water, their adverse effect on human health and also mention their possible remedies. [2+1+2]

6. Describe the preparation and uses of polyphosphazines and polymeric sulphur (PS)n. [5]

7. What are double and complex salts? Write the formulae of the following co-ordination compounds. [2+3]

   a) Dibromotetraaquochromium (III) chloride
   b) Potassium hexacyanocobaltate (II)
   c) Tetrabromocuparate (II)
   d) Tetraamminedichlorocobalt (III)
   e) Hexacyanoferrate (III) ion
   f) Sodium trioxalato aluminate (III)

8. a) What are principal and auxiliary valencies of the metal ion in the complex compound? Illustrate them in [Co (NH₃)₆] Cℓ₃. [2]

   b) Show your familiarity with electronic interpretation of complexes. [3]

9. Explain the followings: [3+2]

   a) Transition elements are good in forming complexes
   b) Show your acquaintance with application of 3-d transition elements.

10. What are transition elements? Explain the following features of transition elements; [1+2+2]

    a) Variable oxidation state
    b) Magnetic properties

11. Define explosives? Give the preparation, properties and uses of trinitrotoluene (TNT). What are plastic explosives? [1+3+1]

12. Define lubricants and mention their functions. Name different types of liquid lubricants with examples. Show your familiarity with types of paint. [2+1+2]

13. a) What are geometrical isomers? Draw the structure of 2-Chloro-3-methylpent-2-ene and specify Z and E configuration. [1+1]

    b) Illustrate enantiomerism with an example. Mention a typical organic molecule which exhibits distereomerism. [1+2]

14. Describe the mechanism involved in the reaction between a tertiary alkyl halide and aqueous caustic potash. How does S_N2 reaction differ from S_N1 in its stereochemistry? [4+1]

15. a) Write the mechanism of bimolecular elimination reaction. [2]

    b) Mention the effect of nucleophile, substrate and solvent on nucleophilic substitution reaction mechanisms. [3]

16. What are bio-degradable and nonbiodegradable polymers? Mention the uses of epoxy resin and fibre reinforced polymer. [2+3]

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	I / I	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) A cricket ball of mass 250g is moving with $\frac{1}{1000}$ th of the velocity of light. Calculate the wavelength of that ball. Also explain whether this cricket ball acts as a particle or wave and why? (Planck's constant = 6.6×10^{-34} JS)   [3]

    b) Explain Sommerfield model of atom. How does this model introduced the concept of sub-shell?   [3]

    c) State Paulie's exclusion principle. How does this principle limit only two electrons in an orbital with their spin opposite?   [2]

2. a) Derive Ostwald's dilution law and write its limitations.   [4]

    b) Calculate the pH of the resulting buffer, when 400 mℓ of 0.2M acetic acid is mixed with 500 mℓ of 0.3M sodium acetate. ($K_a = 1.8 \times 10^{-5}$)   [4]

3. a) Define normal hydrogen electrode. How it is used for the construction of electrochemical series.   [4]

    b) Calculate the EMF of the following cell at 15°C.   [4]

    Cu / Cu^{++} (0.1M) // Ag$^+$ (0.2M) /Ag
    E° Cu^{++} / Cu = 0.34V
    E° Ag / Ag$^+$ = –0.80V

4. What do you mean by Molar heat capacities at constant volume and constant pressure? Calculate the enthalpy change for the synthesis of urea   [3+5]

    $C(S) + 2H_2(g) + \frac{1}{2}O_2(g) + N_2(g) \rightarrow CO(NH_2)_2 (S)$ $\Delta H = ?$

    from the following thermochemical equations.

    a) $C(S) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -394$ kJ
    b) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(\ell)$ $\Delta H = -286$ kJ
    c) $CO(NH_2)_2(S) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(\ell) + N_2(g)$ $\Delta H = -632$ kJ

    OR

    Write short notes on (any two):   [4+4]

    a) Electrochemical theory of corrosion
    b) Bomb calorimeter
    c) Hess law of constant heat summation

Group B

5. a) Explain the structure of $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl.4NH_3$ and $CoCl_3.3NH_3$ on the basis of Werner's theory, if 3, 2, 1 and 0 chloride ions are precipitated with $AgCl$ from their aqueous solutions. [6]

   b) Explain why octahedral complexes of Ni^{+2} ion are outer orbital complex. [2]

OR

On the basis of VBT, explain the structure and hybridization involved in $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ ions. [3+3+2]

Write the IUPAC name of the following complexes.

a) $[Fe(H_2O)_6]^{2+}$ b) $[Cr(NH_3)_2CO_3]Cl$

c) $[Cr(en)_3]Cl_3$ d) $NH_4[Cr(H_2O)_2(NO_3)_4]$

6. a) Define transition elements and write their general outer electronic configurations. [2]

   b) Give reasons for the following [6]

   i) Transition element complexes are coloured
   ii) Transition elements are suitable for complex formation
   iii) Transition element compounds are paramagnetic

7. a) Define hybridization. Give the scheme of hybridization in SF_6 molecule and also predict its geometry. [1+3]

   b) Explain the formation of H_2 molecule on the basis of VBT. [2]

   c) What are silicones? Write some important uses of it. [2]

Group C

8. What does SN^2 represent? Explain it's chemical reaction mechanism with a suitable example. Write a suitable chemical reaction that represents E_1, E_2, SN^1 and pinacol pinacolone rearrangement reaction. [4+4]

OR

Write the difference between addition reaction and elimination reaction. Explain the chemical reaction mechanism of E^1 and give reason why SN^1 is said to represent unimolecular nucleophilic substitution reaction. [3+5]

9. a) What is geometrical isomerism? Write the necessary conditions for a compound to show geometrical isomerism. [1+2]

   b) Taking an example of organic compound, show enantiomers, diasteriomers and meso compounds giving reasons. [3]

   c) Write the general characteristics of enantiomers. [2]

10. a) How is TNG prepared? Write its uses. [2+1]

    b) Differentiate thermosetting and thermoplastic polymer with suitable example. [2]

    c) What is the role of Grignard reagent in the preparation of 1°, 2° and 3° alcohol? [3]

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	I / I	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.

1. a) Write the value of four quantum numbers for the last electron of sodium. [2]

   b) Derive Schrondinger wave equation and mention its implication. [5+1]

2. a) What is pH scale? Write its limitation. [3+1]

   b) 400CC of 0.2M CH_3COOH is mixed with 100CC of semimolar NaOH solution. Calculate the pH of the mixture. [Ka of $CH_3OOH = 1.8\times10^{-5}$] [4]

3. a) What is standard hydrogen electrode? Give the cell notation of Cu electrode with it. [3+1]

   b) The EMF of the combination of given electrode [4]

   i) $AgC\ell + e^- \rightarrow Ag + C\ell^-$ $E = -0.2V$
   ii) $Cu \rightarrow Cu^{++} + 2e^-$ $E = +0.34V$

   is 0.09. Calculate the concentration of Cu^{++} ion in electrode b, where a is in standard condition.

4. Derive the equation which shows that how the heat of reaction depends upon the temperature. Calculate the heat of formation of glucose if enthalpy of combustion of glucose is −2808 KJ, amount of heat evolved by the burning of 1 mole of charcoal is 394 KJ and heat of formation of water is −286 KJ. [4+4]

OR

Write short notes on: [4+4]

   a) Bomb calorimeter
   b) 1st law of thermodynamic

5. a) Give the chemical formula for the following compounds. [2]

   i) Diammine silver (I) iodide
   ii) Pentammine monochlorocabalt (III) Chloride
   iii) Hexaqqua iron (III) chloride
   iv) Potassium tetraiodo mercurate (II)

   b) Give the postulates of Werner's theory of complexes and mention the key point to distinct primary and secondary valencies to central metal atom/ion in a complex with example. [4+2]

OR

   a) Give the postulates of valence bond theory of complexes. [4]

   b) Predict the geometry and magnetic character of $[Ni(CN)_4]^{--}$ and $[Ni(CO)_4]^0$ according to the same theory. [4]

6. a) What are hybrid orbitals? Explain the geometry of NH_3 and PCl_5 on the basis of hybridization. [1+5]

   b) What are silicones? Give the four main properties of silicones. [2]

7. a) Write down the characteristics of transition metal. [2]

   b) Explain the characteristics of 3d transition metals with reference to (i) variable oxidation state (ii) complex formation. [6]

8. a) In which aspect the aquenshydrolysis of methyl bromide differs from aqueous hydrolysis t-butyl bromide. [4+4]

OR

   a) Explain E_1 and E_2 mechanism with suitable examples. [3+2]

   b) Why rearrangement reaction differs from addition one. [2+1]

9. a) What is the minimum requirement for an organic molecule to represent its and trans isomerism? Explain it with suitable example. [2]

   b) Explain diasteriomers, enantiomers and meso compound with suitable examples. [6]

10. a) How you will obtain [3]

    i) Butanol and
    ii) Pentanol from propyl maguesium bromide and benzoic acid from toluene

    b) Give the chemistry of TNT. [2]

    c) Terylene and Telfon are different polymer, explain it. Give the preparation and property of nylon 66. [1+2]

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