TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

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

Subject: - Engineering Chemistry *(SH 403)*

✓ 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? How do you measure standard reduction potential of zinc electrode? Calculate the emf of the cell at 25°C, $Ni/Ni^{++}(0.8M) // Ag^+(0.2M) / Ag$ Given, $E° Ni/Ni^{++} = +0.25V$, $E° Ag/Ag^+ = -0.80V$. [1+1+3]

2. Explain the mechanism of basic buffer. Calculate the PH of the resulting buffer solution containing 100ml of 0.5M NH_4OH and 40ml if 1 M NH_4Cl in which 20cc of 0.5HCl is added. [2+3]

3. What is catalyst promoters? How does a catalyst increase the speed of reaction? Explain with example. Explain intermediate compound formulation theory of catalysis. [1+2+2]

4. What are the main sources of water pollution? Mention the measures to control water pollution. [2+3]

5. What is meant by ozone depletion? Write consequences of global warming and its possible remedies. [2+3]

6. What are biodegradable polymers? Write down the preparation and uses of Bakelite and Epoxy resin. [1+2+2]

7. What are polyphorphazenes? How are different types of polyphorphorzenes prepared? Mention the applications of polythiazyl in engineering field. [1+3+1]

8. Variable oxidation state is the main characteristics of transition elements, explain with reference to 3d series. [5]

9. Explain the followings.
   i) Mn^{+2} is more paramagetic than Cu^{+2}.
   ii) Zn^{+2} compounds are white while Fe^{+2} compounds are colored.
   iii) Transition elements from alloys. [2+2+1]

10. a) Differentiate between double and complex salts. Predict the magnetic properties of $[Co(NH_3)_6]Cl_3$ with the help of EAN. [2+1]
    b) Write the IUPAC name of the followings: [2]
       (i) $Na_3[Al(C_2O_4)_3]$
       (ii) $[C_o(NH_3)_4Cl_2]Cl$
       (iii) $[Cr(NH_3)_6]^{3+}$
       (iv) $[Zn(OH)_4]^{2+}$

11. With the help of VBT approach, point out the differences between $[Fe(CN)_6]^{4-}$ and $[FeF_6]^{3-}$ complex ions. [2.5×2]

12. a) Show your acquaintance with liquid and semi liquid lubricants. [2.5]
    b) What do you understand by paints? Mention the requisites of a good paint. [2.5]

13. What isomerism is shown by tartaric acid and why? Write the possible forms of tartaric acid and mention enantiomers and mesocompound. [5]

14. What is SN reaction? Explain the reaction mechanism of hydrolysis of tertiary alkyl halide by aqueous NaOH. [1+4]

15. Describe the mechanism of E^1 reaction with suitable example. Give an account of Sayteff's rule. [4+1]

16. What are primary and low explosives? Write the preparation and uses of TNT and TNG. [5]

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Subject: - Engineering Chemistry (SH 403)

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1. What is normal hydrogen electrode? Why is salt bridge used in the construction of galvanic cell?
   Calculate the emf of the following cell at 20°C, Cr/Cr^{+++} (0.5M) // $Fe | Fe^{++}$ (0.2M). Given $E°_{Cr/Cr^{+++}} = 0.75V$ and $E°_{Fe^{++}/Fe} = -0.44V$. [1+1+3]

2. Differentiate between acidic and basic buffers. 100 ml of 0.5 M NH_4OH is mixed with 400 ml of 0.1 M NH_4Cl. what will be the pH of this solution. When 20 ml of 0.5 M HCL is added to it? K_b for $NH_3 = 1.8 \times 10^{-5}$ [2+3]

3. Define catalytic promoter and catalytic poison. Explain the adsorption theory of catalysis with a suitable example. [2+3]

4. Write down the major water pollutants and their harmful effects on mankind. Mention their possible remedies. [5]

5. Mention the major gases for causing green house effect and how are these gases released in the atmosphere? Mention the possible measures to control the global warming. [3+2]

6. Write down the preparation of polymeric sulphur nitride. Mention the engineering applications of polymeric sulphur nitride and chalcogenide glass. [2+3]

7. What are biodegradable and non biodegradable polymers? Mention the applications of Bakelite and epoxy resin. [2+3]

8. What are transition elements? Explain the colour of transition elements on the basis of d to d transition. [1+4]

9. What are d block elements? Why does the number of unpaired electron make the compound paramagnetic? Calculate the magnetic moment if the metal ion contains five unpaired electrons. [1+3+1]

10. a) What is primary valency? Describe simple test to distinguish between the following pairs of complexes on the basis of Werner's theory, (i) $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$.

    b) Name the following complexes by IUPAC system
       (i) $[Cr(H_2O)_4(NH_3)_2]Cl_3$ (ii) $[Pt(NH_3)_2Cl_2]$ (iii) $Na_3[Al(C_2O_4)_3]$
       (iv) $[Co(NO_3)_6]^{3-}$ [2.5+2.5]

11. Explain the formation of (i) $[Fe(CN)_6]^{4-}$ and $[FeF_6]^{3-}$ ions with the help of VBT approach. Explain which one is inner orbital complex and outer orbital complex. [2.5+2.5]

12. What are high and low explosives? Write the important uses of TNT and TNG. [2+3]

13. a) What are lubricants? Mention the function of lubricant.
    b) What is paint? What are the major constituents of paint? Mention the requisites of paints. [2.5+2.5]

14. What is optical isomerism? Show all the possible stereoisomers of tartaric acid indicating enantiomers and meso-forms. [1+4]

15. Explain why SN^1 reaction gives the products with both retention and inversion of configuration but SN^2 gives only inversion of configuration. Write the mechanism of reaction between tertiary alkyl halide and aqueous sodium hydroxide. [2+3]

16. Explain the mechanism of E^1 reaction with a suitable example. Write the differences between E^1 and E^2 reactions mechanism. [3+2]

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TRIBHUVAN UNIVERSITY
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2076 Ashwin

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Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry (SH 403)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
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1. What is single electrode potential? Write down the cell notation for standard hydrogen electrode. How will you predict the spontaneity of any redox system using emf? The value of E° for the $Zn(s) + Cu^{2+} (aq) \rightarrow Cu (s) + Zn^{2+} (aq)$ is 1.10 V. What is the value of E_{cell} when the concentration of Cu^{2+} is 1.0 M and the concentration of Zn^{2+} is 0.025 M? [1+1+1+2]

2. What happens when a small amount of acid or base is added on a buffer solution of acetic acid and sodium acetate? Determine the amount of sodium acetate required in 100 ml 0.2M acetic acid solution to prepare a buffer solution of pH 5.8 pK_a for acetic acid = 4.74 [2+3]

3. Differentiate between negative catalysis and catalytic poisoning. How a catalyst work and what is the role of promoter? [2+2+1]

4. What are the primary and secondary air pollutants? Describe with examples. What is acid rain and how does it occur? [2+1+2]

5. What is water pollution? What are the major pollutants that should be monitored in order to explain the drinking water quality? [1+4]

6. a) How do you differentiate a double salt from a complex? Explain with examples. [2]

   b) Write the IUPAC name and calculate the effective atomic number of following complexes. [3]

   (i) $[Co(NH_3)_3Cl_3]$ (ii) $K_3[Fe(C_2O_4)_3]$ (iii) $[Al(OH)(H_2O)_5]^{2+}$

7. What are low and high spin complexes? How does valance bond theory explain the geometry and magnetic behavior of a complex? Explain with reference to $[Fe(CN)_6]^{3-}$ [1+2+2]

8. Give the reasons for:

   a) Cu^+ compounds are diamagnetic where as Cu^{++} compounds are paramagnetic.

   b) Ti^{+++} compounds are colored where as Ti^{++++} compounds are colorless. [2.5+2.5]

9. What are transition elements? Why are they called so? Why do transition elements form complex. [1+1+3]

10. Define the following terms: [1×5]

    a) Primary explosives   b) Secondary explosives   c) Tertiary explosives
    d) Low explosives   e) High explosives

11. Explain the chemical separation of racemic mixture. Write the structure cis and trans isomers of cyclo-octene. [2+3]

12. Write all the possible stereoisomers of tartaric acid. 'The meso form of tartaric acid cannot rotate plan polarized light.' Explain. [3+2]

13. Define the following terms: [1×5]

    a) Solid lubricant   b) Enamel   c) Varnish   d) Semi solid lubricants
    e) Emulsion paints

14. What are biodegradable polymers? Describe the preparation and uses of polystyrene. [1+2+2]

15. Describe the preparation and uses of polyphosphazine. 'The SN^1 reaction gives both retention and inversion product but SN^2 reaction fevers inversion product.' Explain. [2+3]

16. What do you mean by elimination reaction? Explain the reaction mechanism of E1 reaction. [2+3]

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✓ *Attempt **All** questions.*
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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
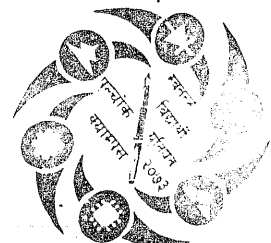
9. Write the expected and actual electronic configuration of Cr in box notation. Why the actual electronic configuration of Cr is different from expected electronic configuration? In the 3-d transition series the size of atom decreases from Sc to Cr but the size remains almost similar from Cr to Zn. 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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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 Buffer. Write the mechanism of acidic buffer. Calculate the pH of the solution formed by adding 0.2 g of sodium acetate in 200 mL 0.1 M acetic acid. pKa for acetic acid = 4.74.   [1+2+2]

2. What is standard hydrogen electrode? How is it used to measure the single electrode potential? Why is salt bridge used in construction of galvanic cell? Calculate the emf of the following cell at 25°C.   [1+1+1+2]
$$[E^0_{Ni^{++}/Ni} = -0.24V \text{ and } E^0_{Pb^{++}/Pb} = -0.12V].$$
$$Ni\,(s)\,/Ni^{2+}(aq)\,(1M)//Pb^{2+}(aq)\,(1M)/Pb(s)$$

3. Explain with an example the mechanism of adsorption theory of catalysis. Write the differences between homogenous and heterogenous catalysis.   [4+1]

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

5. Write the formation, effects and remedies of SOx and NOx.   [2.5+2.5]

6. What are biodegradable polymers? Give the preparation and uses of Nylon 6,6 and polyurethane.   [1+2+2]

7. Describe the preparation and uses of polymeric sulphur $(PS)_n$ and polyphosphazines.   [2.5+2.5]

8. Give an account for the following: [1+1+3]
   a) Cu^{2+} $(3d^9)$ is more stable than Cu^+ $(3d^{10})$. Justify the statement.
   b) Why Zinc is called non-typical transition element?
   c) Explain magnetic properties of transition elements.

9. Explain with reasons:
   a) Transition metals can form most of the complex compounds.
   b) Zinc (II) compounds are white and diamagnetic while copper (II) compounds are colored and paramagnetic.   [2.5+2.5]

10. Explain the formation of $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ on the basis of Valence Bond Theory and also predict their magnetic property.   [2+2+1]

11. Write the basic assumptions of Werner's theory of co-ordination compounds. $CoCl_3.4NH_3$ gives a precipitate with $AgNO_3$ solution. Explain it on the basis of Werner's theory.   [3+2]

12. What are plastic explosives? Write the advantages of plastic explosives. Write the preparation of TNT, TNG and nitrocellulose.   [1+1+3]

13. a) What are lubricants? Show your familiarity with application of different types of lubricants.
    b) Explain the method of application of paints in galvanized iron.   [1+2+2]

14. a) Explain geometrical isomerism with examples.   [1.5]
    b) Write all possible stereoisomers of 2,3-dibromopentane. Identify all possible enantiomers and diastereomers from the stereoisomers.   [3.5]

15. What are the differences between E^1 and E^2 reactions? Explain the reaction mechanism for the reaction of primary alkyl halide with alcoholic NaOH.   [2+3]

16. Why does SN^1 reaction give both retention and inversion isomers but SN^2 gives only inversion isomer? Write the mechanism for the reaction between bromoethane and aq.NaOH.   [2+3]

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03   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
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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.
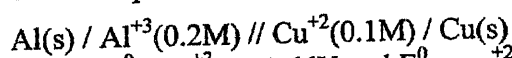
   Al(s) / Al^{+3}(0.2M) // Cu^{+2}(0.1M) / Cu(s)
   Given: $E^0_{Al/Al^{+3}}$ = +1.66V and $E^0_{Cu/Cu^{+2}}$ = -0.34 V   [1+1.5+2.5]

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 = 1.8×10^{-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]
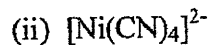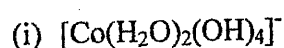
8. $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$, both are octahedral complexes. Explain the difference between these two complexes on the basis of VBT.   [5]

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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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]
$$2Al + 3Z_nSO_4 \rightarrow Al_2(SO_4)_3 + Z_n \text{ at } 298K$$
(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 following: (a) TNT (b) Dynamite [1+2+2]
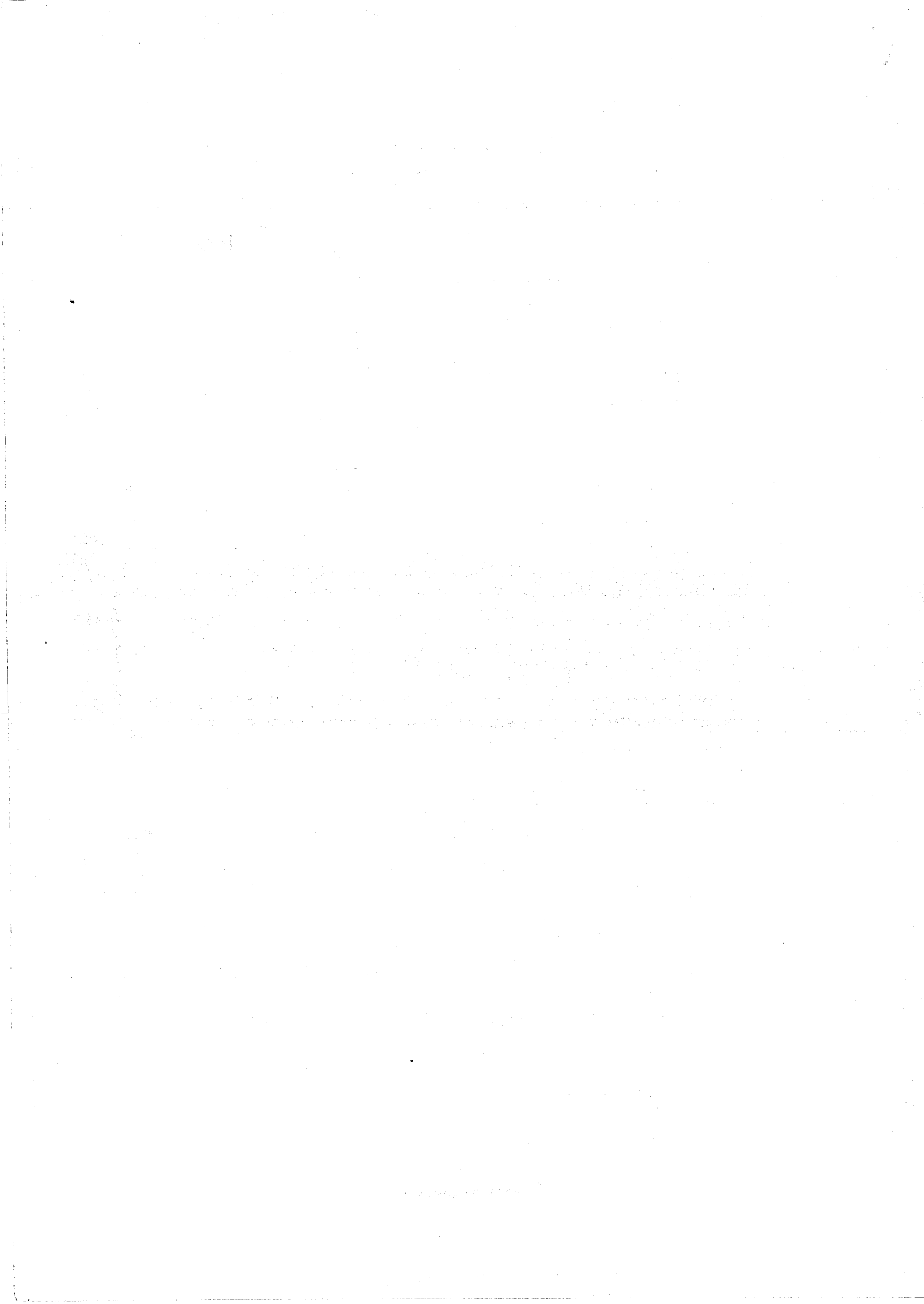
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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Chemistry *(SH403)*

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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]

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

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

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.	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. Derive the equation required to calculate the emf of cell at non-standard condition. What are the factors that affect the single electrode potential value? Calculate the oxidation electrode potential of given half cell reaction at 20°C. [2+1+2]

   $Fe^{+++}(0.1M) + e \rightarrow Fe^{++}(0.2M), E^0 = +0.77V$
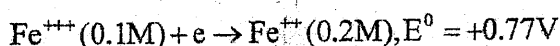
2. What are the criteria for buffer system? Calculate the change in pH of buffer system having 200 cc of 0.1 m CH3COOH and 0.1 M CH3COONa when 1 millimole NaOH is added into it. ($K_a = 1.8 \times 10^{-5}$) [2+3]

3. What is autocatalysis? Explain the mechanism of adsorption theory of catalysis with example. [1+4]

4. What are the major pollutants responsible for water pollution? How do the oxides of sulphur and nitrogen make water acidic? [2+3]

5. What is meant by ozone depletion? Write its causes and consequences. [2+3]

6. a) What are chalcogenide glasses? Give an account of preparation and uses of chalcogenide glasses in the engineering field. [1+2+2]

   b) Write down the preparation of cyclic silicones.

7. a) Give an account for the biodegradable and non-biodegradable polymers with suitable examples. [2.5×2]

   b) What are fibers-reinforced plastics? Write down its applications.

8. Explain the origin of the adsorption spectra of transition elements with d to d transitions. [5]

9. Mention the main applications of 3d elements and give main causes of variable oxidation states shown by transition elements. [3+2]

10. a) Describe the simple test to distinguish between the following pairs of compounds on the basis of Werner's theory. $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$ [2+2+1]

    b) Name the following complexes by IUPAC system.

       i) $K_3[AlF_6]$

       ii) $[Co(en)_3]Br_3$

       iii) $[Cr(H_2O)_5Cl]Cl_2$

       iv) $[Pt(NH_3)_4Cl_2]Cl_2$

    c) State EAN rule.

11. Using VBT, predict the possible number of unpaired number in the following complex compounds. $K_4[Fe(CN)_6]$ and $[FeF_6]^{3-}$ [2.5+2.5]

12. Write the mechanism for the conversion of Bromomethane into methanol in presence of aqueous alkali. Also explain the stereochemistry of the reaction. [3+2]

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

14. Write down the possible geometrical isomer of but-2-ene-1, 4-dioic acid. Why does this compound exhibit geometrical isomerism? Explain the difference between enantiomer and diastereoisomer giving an example of 3-bromo-2-butanol. [1+1+3]

15. What is the requisite of good explosive? How can you prepare TNT form benzene? Why does detonator required for the explosion of TNT? [2+2+1]

16. a) Show your acquaintance with liquid and semi-liquid lubricants. Under what situations greases are used? [3+2]

b) What do you understand by paints? Mention the requisites of good paint.

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03   TRIBHUVAN UNIVERSITY
   INSTITUTE OF ENGINEERING
Examination Control Division
         2071 Chaitra

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 SHE? Calculate the emf of electrode couple of $E^\circ_{Sn/Sn^{+2}} = -1.4V$ and $E^\circ_{Fe^{+2}/Fe^{+3}} = -0.77V$. Where the concentration of Sn^{+2}, Fe^{+2} and Fe^{+3} are 0.2M 0.1M and 1 M respectively. [2+3]

2. Explain the mechanism of buffer action with a suitable example. Calculate the weight in gram of NH_4Cl required to prepare buffer solution having pH = 9.35 in 200 cc of 0.2N ammonia solution. (pkb = 4.74) [3+2]

3. What is heterogeneous catalysis? How does a catalyst alter the rate of reaction? Give a brief account on the intermediate compound formation theory of catalysis. [1+1+3]

4. a) What is ozone depletion? Write the chemical reactions involved in the stratospheric ozone depletion by nitric oxide? [1+2+2]

   b) How does carbon dioxide cause atmospheric pollution?

5. What are the major water pollutants and their harmful effect? Mention the possible measures to control water pollution. [2+3]

6. a) Write the engineering applications of Silicone and give the structure of cyclic and cross linked silicons. [3+2]

   b) Write the preparation of polyphosphazine and its uses.

7. What are biodegradable polymers? Write down the preparation and uses of Nylon 6.6 and Teflon. [1+4]

8. a) Why do transition metals form complex compound? [3+2]

   b) Explain why the 3d transition series having completely filled d-orbital cannot form coloured compounds.

9. What are transition elements? Why does the presence of unpaired electrons make a substance paramagnetic in nature? Explain it with magnetic moment measurement. [1+4]

10. Name the following complexes by IUPAC system: [2+3]

    i) $[Cr(H_2O)_4(NH_3)_2] Br_3$
    ii) $[CuCl_2(CH_3NH_2)_2]$
    iii) $Ni[PtCl_6]$
    iv) $[Cr(NH_3)_6]^{3+}$

    State and explain EAN rule as applied to metal complexes.

11. Differentiate between inner and outer orbital complexes. Magnetic measurement on $K_3[Fe(CN)_6]$ indicates the presence of one unpaired electron, predict on the basis of VBT whether the given complex is inner or outer complex. [2+3]

12. Define explosives. Why are the primary explosives called "detonators"? Write the reaction of toluene forming an explosive. Mention the important uses of GTN and plastic explosives.[1+1+1+2]

13. a) What are solid lubricants? Mention the types and function of lubricants with examples.[1+2+2]

    b) Explain the method of application of paint in galvanized iron.
                                                                              [2+3]
14. a) What isomerism is shown by tartaric acid and why?

    b) Define enantiomers with examples. Differentiate between racemic mixture and mesocompound.

15. Explain the reaction mechanism for the hydrolysis of tertiary alkyl halide by aqueous NaOH. What solvent favours the reaction mechanism?   [4+1]

16. What is Saytzeff's rule? Describe the mechanism for the reaction of 3°alkyl halide in alcoholic alkali.   [2+3]

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03   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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 buffer solution? Calculate the pH of 500 cc of 0.2 M CH_3COOH solution when 2 g of sodium acetate is added. [K_a for CH_3COOH is 1.8×10^{-4}] [1+4]

2. What is Daniell cell? Answer the following question using equation (a) and (b) [1+4]

    (a) Fe^{++} (0.2M) = F^{+++} + e (0.1M), E^0 = -0.77V, (b) Cu (0.3M) - 2e = Cu^{++}, E^0 = -0.34V,

    (i) net cell reaction (ii) spontaneity of redox reaction (iii) cell notation (iv) emf of cell

3. What are catalytic promoter and catalytic poison? Explain their activity on the basis of adsorption theory of catalysis. [2+3]

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

    b) Discuss about the air pollution caused by oxide of nonmetals? [2]

5. What are the major water pollutants? Point out their adverse effect and the possible measures to control water pollution. [1+2+2]

6. Write the preparation and uses of Teflon and epoxy resin. What are conducting polymers? Point out their applications in engineering field. [3+1+1]

7. a) Give preparation and uses of the nonmetallic super conductor. [3+2]

    b) Write down the main characteristic of inorganic polymers.

8. Give an account for the followings:

    i) Transition metals are well known to form complexs. [2]

    ii) Copper (I) compounds are white and diamegnetic where as copper (II) compounds are colored and paramagnetic. [2]

    iii) Zinc is nontypical transtion metal. [1]

9. a) Explain the variable oxidation states of transition elements. Which divalent metal has maximum paramagnetic character among the first transition metals? [2.5+1+1.5]

    b) A transition metal forms alloys with other transition metals easily. Why? Explain.

10. Explain how the two complexes of Ni, $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]^{o}$ have different structures but do not differ in their magnetic behavior (Ni = 28). [5]

11. a) Write the IUPAC name of the following compounds/ions [2+1+2]

    I) $[Co(NH_3)_5NO_2] Cl_2$
    II) $[Fe(C_2O_4)_3]^{3-}$
    III) $[Cr(en)_2Cl_2]^+$
    IV) $NH_4[Cr(H_2O)_2(NCS)_4]$

    b) What is complex compound? What do you understand by principal and auxiliary valency of the central ion in complex compound? Illustrate them in $[Co(NH_3)_6]Cl_3$.

12. a) What are lubricating oils? Indicate its application in engineering work. [1+2]

b) Show your familiarity with the types of paint. [2]

13. a) Write the difference between enantiomers and diasterioisomers giving appropriate examples. [3+2]

b) Write Cis, Trans and Z, E notations for the possible isomes of but-2-endioic acid.

14. a) Explain the mechanism involved in the reaction between bromomethane and aqueous NaOH. [3]

b) How do nucleophile and solvent affect this type of reaction? [2]

15. a) Differentiate between E^1 and E^2 reaction. [2+3]

b) Explain the reaction mechanism for the dehydrohalogination of 3°alkyl halide.

16. What are low explosives? Write the preparation and uses of GTN and TNT. [1+4]

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INSTITUTE OF ENGINEERING

Examination Control Division

2070 Ashad

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 and buffer capacity? To 100 ml of 0.1 M acetic acid, 0.1 gm of sodium hydroxide is added. Find the pH of the resulting solution. (pk_a for acetic acid is 4.74) [2+3]

2. How does a galvanic cell differ from an electrolytic cell? Calculate the EMF of the cell: Zn/Zn^{++} (0.001M) // Ag^+ (0.1M) / Ag. The standard potential of Ag/Ag^+ half cell is 0.080 V and Zn/Zn^{++} is - 0.76 V [2+3]

3. a) What are promoters? Mention the action of promoters. [1+1]
   b) Describe the adsorption theory of catalysis with a suitable example. [3]

4. a) Write down the sources and defects of sulphur oxides. [3]
   b) Explain the causes and effects of ozone layer depletion. [2]

5. What are the major water pollutants and their harmful effect? Mention the possible measures to control water pollution. [3+2]

6. Write short notes on (i) Sulphur based polymers (ii) Chalcogenide glass. [3+2]

7. a) Give preparation and uses of Nylon.6,6 and polyurethane. [4]
   b) What are engineering applications of conducting polymer? [1]

8. a) Write the important characteristics of transition elements. [2.5]
   b) Explain the magnetic properties of the transition elements. [2.5]

9. Explain the following: [2.5+2.5]
   a) Complexes of transition elements are generally coloured.
   b) Most of the transition elements are paramagnetic.

10. What are primary and secondary valencies of metal? Explain the structure of $K_4[Fe(CN)]_6$ on the basis of Werner's theory. [2+3]

11. a) With the valence bond concept, explain the geometry and magnetic character of the complex $[Ni(CO)_4]$. Write down one of the limitations of valence bond theory. [2+1]
    b) Write the IUPAC name of the following co-ordination compounds. [2]
       i) $K_2[PtF_6]$
       ii) $K_3[Al(C_2O_4)_3]$
       iii) $[Co(NH_3)_5SO_4]Br$
       iv) $[Pt(NH_3)_4Cl_2]SO_4$

12. Explain the reaction mechanism for the hydrolysis of tertiary butyl bromide by aqueous NaOH. Differentiate between SN^1 and SN^2 mechanism. [3+2]

13. a) How do enantiomers differs with diasteoisomers? Illustrate with an example. [1+2]
    b) What isomerism is shown by 2-bromo 1-chloropropene? Mention Z and E notation for the compound. [2]

14. What are secondary explosives? Give preparation and properties and uses of GTN and TNT. [2+3]

15. What do you mean by Elimination reactions? Explain the reation mechanism for the reaction between primary alkyl halide and alcoholic NaOH. [2+3]

16. a) What are lubricating oils? Indicate their importance. [1+2]
    b) Show your familiarity with types of paints. [2]

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

Subject: - Engineering Chemistry (SH 403)

✓ 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? Calculate the emf of the following cell at 25°C $Mg|Mg^{++}(0.1M)//Ag^{+}(1M)/Ag$. Given $E°Mg^{++}/Mg = -2.37V$, $E°Ag/Ag^{+} = -0.80V$. [2+3]

2. Explain the mechanism of basic buffer. Write the equation for acidic buffer. 0.005gm equivalent of KOH is added to 400ml of 0.1N acetic acid, calculate the pH of the mixture. (Ka for acetic acid $= 1.8\times10^{-5}$). [1.5 + 0.5+3]

3. Define heterogeneous catalysis. Point out some characteristics of catalytic reactions and mention its industrial application. [1+4]

4. a) Define soil pollution. What are its sources? [1+3]

   b) Explain cause and effect of Ozone layer depletion. [4]

   c) Give averse effects of (i) pb (ii) phosphates in water. [2]

5. What are the general characteristics of inorganic polymer? What do you mean by cross linked? What are the engineering uses of chaleagenide polymer? [2+1+2]

6. Write short note on fibre reinforced resin. [5]

7. a) Explain variable oxidation states of transition metals, along with nature of oxides. [4]

   b) Explain the colour of $[Ti(H_2o)_6]^{+3}$ i on. [4]

   c) Transition metal complex ions with $d°$ or d^{10} configuration are colourless. Why? [2]

8. a) Explain the formation of $[Ni(CO)_4]°$ Complex on the basic of VBT. Also predict its geometry and magnetism with reason. [2+1]

   b) Write the formula of the following co-ordination compounds. [0.5×4]

      i) Dichloro-tetra-aqua chromium (III) cation
      ii) Dicyano argentate (I) ion
      iii) Sodium hexa nitrito cobaltate (III)
      iv) Hexa-cyanoferrate (III) ion

9. a) What are primary explosives and plastic explosives? Give the methods of preparation of TNT and uses. [1+1+3]

   b) Explain lubricating oils with types. [3]

   c) What are requisites of a good paint? [3]

10. a) Define: (i) Optical isomers (ii) Racemic mixture (iii) Chirality (iv) Optical activity. [4]

    b) Get differences in between enantiomers and di-stereomers. [3]

    c) How many meso-forms are possible for $CH_2OH (CHOH)_3 CH_2OH$? Write their Fischer projection. [2]

11. a) Define lubricant and lubrication and explain the main purpose of lubricant. [1+1]

    b) What is paint? What are the requisites of a good paint? [1+2]

12. a) Describe the mechanism involved in the reaction between a tertiary alkylhalide and aqueaus caustic potash. [1.5+1.5]

    b) What type of solvent favours the unimolecular nucleophilic substitution reaction mechanism? What is meant by elimination reaction? [1+1]

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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. 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) $[C_r(NH_3)_6]^{3+}$
    ii) $[Pt(NH_3)_2Cl_2]$
    iii) $Na_3[C_r(C_2O_4)_3]$
    iv) $[CO(NH_3)_4Cl_2]Cl$
    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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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. 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) $Zn^{++} + Ag \rightarrow Zn + Ag^+$
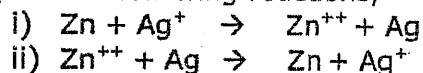
   Given, $E^0{}_{Zn^{++}/Zn} = -0.76V$, $E^0{}_{Ag^+/Ag} = 0.80V$ [1+1+3]

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) $K_2[HgI_4]$
     ii) $K_4[Fe(CN)_6]$
     iii) $[Co(NH_3)_5cl]^{2-}$
     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.	New Back (2066 Batch & Later)		
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 meant by emf of a cell? From the given electrode potential values, answer the following. [1+4]

    $Zn \rightarrow Zn^{++}$ $E° = +0.76V$
    $Fe \rightarrow Fe^{++}$ $E° = +0.44V$

    a) Which of the above electrode acts as anode and why?
    b) Write the electrode and cell reactions.
    c) Calculate the potential of the cell at 27°C, if concentration of Zn^{++} and Fe^{++} ions is 0.01M and 0.05M respectively.

2. a) What is buffer capacity of a buffer solution? How does a solution containing a mixture of sodium acetate and acetic acid maintain its constant pH value even on the addition of strong acid or alkali? Explain. [2.5]

    b) Calculate the pH of a buffer solution prepared by mixing 100ml of 0.2m NH_4CL and 200ml of 0.3m ammonia solution which is 3.1% ionized in the dilute solution. [2.5]

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

    a) Ozone layer depletion and it's prevention
    b) Global warming

4. What is water pollution? Point out the major causes of water pollution, their adverse effects and possible remedies. [1+2+1+1]

5. a) What are promotors? Describe the action of promotors. [1+1]

    b) What is heterogeneous catalysis? Describe the absorption theory of catalysis with a suitable example. [1+2]

6. a) Write the structure and uses of (i) Polyurethane (ii) Polyphosphazine. [1.5+1.5]

    b) Write any four applications of silicones. [2]

7. What is a lubricant? Mention the types and functions of lubricants with examples. [1+1+3]

8. Which of the 3d-series element is not a transition element and why? Why transition elements show variable oxidation state? Explain the stability of oxidation state taking the reference of 3d-series elements. [1+2+2]

9. What is the difference between double salt and complex salts? What is Sidwick effective atomic number rule? What are it's significances? [1+2+2]

10. a) Explain why $[Co(NH_3)_6]Cl_3$ gives white precipitate when treated with aqueous solution of $AgNO_3$ but $[Co(NH_3)_3Cl_3]$ does not? Whether the complex $[Co(NH_3)_6]Cl_3$ is outer or inner orbital complex? [2]

b) Explain the properties of transition elements based on (i) Magnetism (ii) Catalytic property [3]

11. a) Explain the formation of $[Ni(CN)_4]^{2-}$ on the basis of valence bond theory and predict its magnetic behavior. [3]

   b) Write the IUPAC name of the following complexes: [2]

   i) $[Ni(en)_2Cl_2]$
   ii) $[Al(OH)(H_2O)5]^{2+}$
   iii) $[Fe F_6]^{3-}$
   iv) $[Co(NH_3)_4 ClSO_4]$

12. What is the difference between plastic explosive and high explosive? Write the preparation and uses of gun cotton and TNT. [1+2+2]

13. What are the differences between enantiomers and diasteriomers. Explain with reference to a compound. Mention the methods of resolution with example and specify 'E' and 'Z' configuration of 2-chloro-3-methyl-2-pentene. [1.5+2+1.5]

14. Write the mechanism of the reaction of tertiary alkyl halide with (a) Aqueous KOH (b) Alcoholic KOH. Mention the factors affecting the rate of such reactions. [2+2+1]

15. Show your acquaintance with: [2+1.5+1.5]

   a) Conducting Polymer
   b) Chalcogenide Glass
   c) Fibre reinforced Polymer

16. What are Cis and Trans isomers? Explain with reference to a cyclic compound and unsaturated acid. Why is Trans isomer more stable than cis-isomer? [2+2+1]

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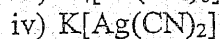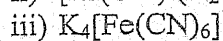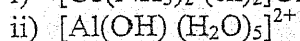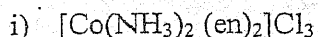
12. What is plastic explosive? How do you prepare dynamite and gun cotton?　　[1+2+2]

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]
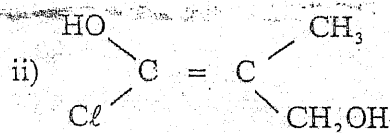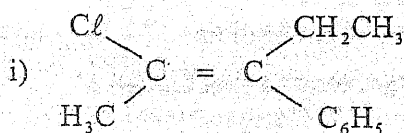
　　b) What is lubricant? Give an example of emulsion and solid lubricant. Mention their specific functions.　　　　　[0.5+1+1]

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)

$$Cl\diagdown \quad \diagup CH_2CH_3$$
$$\qquad C = C$$
$$H_3C\diagup \quad \diagdown C_6H_5$$

　　ii)

$$HO\diagdown \quad \diagup CH_3$$
$$\qquad C = C$$
$$Cl\diagup \quad \diagdown CH_2OH$$

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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