

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

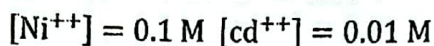
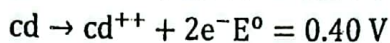
2083 Baishakh

Exam. Level	Back (New Course)		
	BE	BEL, BEL, BCT, BAM, BIE, BGE, BAS	Full Marks
Programme			60
Year / Part	I / II		Pass Marks
			24
			Time
			3 hrs.

Subject: - Engineering Chemistry (ENSH 153)

- ✓ 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 salt bridge. What is the role of salt bridge? From the given information, answer the following questions. [1+1+3]



- i) Identify anode and cathode while constructing the galvanic cell with reasons.
- ii) Write the symbolic representation of the galvanic cell when above given electrodes are coupled.
- iii) Calculate the EMF of the galvanic cell at 25°C.

OR

What is polarization and overpotential? Write Tafel plots equation and mention its applications. [2+3]

2. Explain, how the acidic buffer solution resists the change in pH on addition of small amount of acid or base. What is the pH of resulting mixture obtained by mixing 100 ml of 0.2 M HCl and 50 ml of 0.5 M NH_4OH solution. (K_b for ammonia = 1.8×10^{-5}). [2+3]
3. Define homogeneous and heterogeneous catalysis with examples. Discuss the selection criteria of a catalyst. [3+2]
4. Define chromatographic technique. Write the principle and application of thin layer chromatography. [1+2+2]

OR

Write down the principle of IR spectroscopy. Discuss the significance of functional group region and fingerprint region in IR spectrum. [3+2]

5. What is chelate? Using VBT, predict the geometry and magnetic property of $[\text{CoF}_4]^-$. Write the formula of following co-ordination compounds. [1+3+1]
 - i) Triamminetriaquachromium (III) chloride
 - ii) Potassium trioxalatoaluminate (III)
6. a) What are the postulates of crystal field theory? Explain crystal field splitting of d-orbitals in an octahedral complex. [2+2]
 - b) Give an applications of aluminum alloy. [1]
7. a) What is BOD and COD and their consequences with reference to water pollution? Discuss the steps involved in the industrial treatment of wastewater. [3+2]
 - b) Describe your idea about the segregation and management of solid waste. Also, discuss the challenges to be faced during the process of waste to energy implementation. [3+2]

8. Classify nanomaterials based on their dimensions including examples. Explain Chemical Vapor Deposition (CVD) process in detail. [2+3]
9. a) How does addition polymer differ from condensation polymer? Write down the mechanism of cationic polymerization reaction with a suitable example. [2+3]
- b) What is carbon fiber? Write the preparation and uses of kevlar and polymethyl methacrylate (PMMA). [1+2+2]

OR

Write short notes on:

[2×2.5]

- a) Chitin
- b) Polythiazyl
10. a) What are plastic explosives? Write the preparation and application of nitroglycerine. [1+2]
- b) What are the types and functions of lubricant? [1+1]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

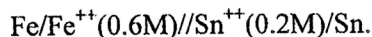
2082 Bhadra

Exam. Level	Regular (New Course)		
	BE	Full Marks	60
Programme	BEL, BEL, BCT, BAM, BIE, BAS, BGE	Pass Marks	24
	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (ENSH 153)

- ✓ 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 a galvanic cell? Draw a diagram of a Daniel cell. Calculate the emf of the following cell at 25°C. [1+1+3]



Given: $E^\circ_{\text{Fe}^{++}/\text{Fe}} = -0.44\text{V}$ and $E^\circ_{\text{Sn}^{++}/\text{Sn}} = -0.14\text{V}$.

OR

Write down the Butler-Volmer equation and its uses. Explain the charging and discharging process in lead acid battery with suitable chemical reactions. [2+3]

2. Derive the Henderson's equation for basic buffer. If 3.0 milli mole of NaOH is added to 100 ml of a buffer which is 0.10 M in acetic acid and 0.1 M in sodium acetate, what will be the change in pH of solution? [pKa=4.74]. [1+4]
3. Define photocatalysis and electrocatalysis. Explain the photocatalytic process of water splitting. [1+1+3]
4. Write the principle of chromatography along with its applications. How is X-ray diffraction method useful in the analysis of crystalline structure? [3+2]

OR

Describe the principle of NMR spectroscopy. Draw and explain NMR spectrum of ethanol. [3+2]

5. On the basis of VBT, explain the structure and hybridization involved in $[\text{Ni}(\text{CO})_4]$. Write the IUPAC names of followings complexes. [3+2]
- i) $[\text{Cr}(\text{en})_3]\text{Br}_3$
 - ii) $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$
 - iii) $\text{K}_3[\text{AlF}_6]$
 - iv) $[\text{Cr}(\text{NH}_3)_4\text{SO}_4]\text{NO}_3$
6. Explain crystal field splitting of d orbitals in tetrahedral complex. Also describe the color formation process in complexes with an example. [3+2]
7. a) What is green chemistry? Explain two principles of green chemistry with suitable examples. Discuss COD and its consequences with reference to water pollution. [1+2+2]
- b) Discuss the impacts of SOx and NOx on the environment and human health? How can we control emission containing SOx? [3+2]
8. Define nanofibers and Mxene. Discuss physical vapor deposition (PVD) method for preparation of nanomaterials. [2+3]
9. a) Define fiber reinforced polymer. Write the preparation and use of polycarbonate and epoxy resin. [1+2+2]

- b) Differentiate between addition and condensation polymerization. Write the mechanism of anionic polymerization reaction with a suitable example. [2+3]
OR

Write short notes on:

[2×2.5]

- i) Cellulose
- ii) Polyphosphazene

10. a) What is primary explosive? Write the preparation and uses of TNT. [1+2]
b) Write the functions of lubricants. What are the requisite of paints? [1+1]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2082 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	60
Programme	BEL, BEI, BCT, BAM, BIE, BGE, BAS	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (SH 153)

- ✓ 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 polarization and overvoltage. [1+4]

An electrochemical cell consists of a nickel electrode dipped in 0.1 M NiSO₄ solution and a silver electrode dipped in 0.05 M AgNO₃ solution. Write the cell notation; cell reaction and calculate the emf of the cell at 30°C. The standard electrode potentials of nickel and silver electrodes are -0.25 V and +0.80 V respectively.

OR

Give the working principle of lead acid battery. What are its uses? Also mention its advantages and disadvantages. [2+1+2]

2. a) How does a solution containing the mixture of benzoic acid and sodium benzoate maintain its constant pH value even on the addition of small amount of strong acid or alkali? Explain. [3]
- b) Calculate the concentration of sodium formate, that must be present in 0.10 M solution of formic acid to prepare a buffer solution of pH 3.80. K_a for formic acid is 1.8×10⁻⁴. [2]
3. Discuss any four selection criteria of a catalyst. Explain the phenomenon of electrocatalytic water splitting. [2+3]
4. Write the principle and applications of NMR spectroscopy. Why is tetramethylsilane is used as a reference compound in NMR spectroscopy? [4+1]

OR

- a) Explain the principle involved in the separation of components of a mixture by paper chromatography. [2]
- b) Show your acquaintance to hypsochromic shift and bathochromic shift in UV visible spectroscopy. [3]
5. a) What is a complex compound? Explain crystal field splitting of d⁷ orbitals in octahedral complex. [1+2]
- b) Define alloys with examples. Give application of aluminum alloys. [1+1]
6. a) [NiCl₄]²⁻ is tetrahedral and paramagnetic while [Ni(CN)₄]²⁻ is square planar and diamagnetic. Explain with reference to VBT. Write the IUPAC name of the following complexes: [4+1]
- i) Na₃[AgF₄]
- ii) [Co(en)₃] Br₃

7. a) Explain about any four principles of green chemistry. What are heavy metal ions? Discuss any suitable method for the removal of heavy metal ions from industrial wastewater. [2+3]
- b) What are air pollutants? How do particulate matter (PM) and Greenhouse gases (GHGs) cause air pollution? Write their effects and remedies. [1+2+2]
8. How is carbon nanotube different from graphene? Discuss nanomaterials of various dimensions with examples. [2+3]
9. a) Write the preparation and uses of polycarbonate and polyurethane. [2.5+2.5]
- b) Discuss about an addition polymerization with an example. Explain about the free radical mechanism of Polymerization. [2+3]

OR

What are conducting polymers? Explain the preparation and uses of polyaniline (PANI). Show your acquaintance with cellulose. [1+2.5+1.5]

10. a) What are solid lubricants? Why is graphite used as a lubricant? [1+2]
- b) Give the preparation of TNT and GTN. [2]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	60
Programme	BEL, BEI, BCT, BAM, BIE, BGE, BAS	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Chemistry (SH 153)

- ✓ 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. The standard reduction potential of Cd^{++}/Cd and Ni^{++}/Ni electrodes are -0.403 V and -0.25 V respectively. Construct a galvanic cell using these electrodes so the standard emf of the cell becomes positive. For what concentration of Cd the emf of the cell at 25°C becomes zero, if the concentration of Ni is 0.01M. [1+4]

OR

- What is Lithium ion battery? Write the reactions involved during discharging and charging of this battery. Write its advantages and disadvantages. [1+2+2]
2. Taking suitable example, explain how the basic buffer solution resists the change in pH with the addition of small amount of acid or base.
If 0.2 gm of NaOH is added to 1 liter of buffer solution containing 0.1M NH_4OH and 0.2M NH_4Cl , what will be the pH of resulting solution? (pK_b for ammonia = 4.74). [2+3]
 3. How are the catalysts used in the field of pollution control? Explain. Write any two examples of biocatalyst used in degradation of dyes. [4+1]
 4. What is Chromatography? Explain the principle and application of thin layer chromatography. How does it vary from paper chromatography? [1+3+1]

OR

Write the principle of IR spectroscopy. Mention its applications. [3+2]

5. a) What are inner and outer orbital octahedral complexes? On the basis of VBT predict the magnetism and geometry of $[\text{Fe}(\text{CN})_6]^{4-}$ [1+2.5]
b) From the given IUPAC names write the molecular formula of the following complexes. [1.5]
 - i) Potassiumtetraiodomercurate (II)
 - ii) Dichloro-bis- ethylenediaminenickel (IV) sulphate
 - iii) Tetraaquadichlorocobalt (III) chloride
6. What are metallic alloys? Give examples with their uses. Using CFT, explain the color formation and magnetic property of $[\text{Cu}(\text{NH}_3)_6]^{3+}$. [2+3]
7. a) What is the goal of green chemistry? Mention any four principles of green chemistry. [1+4]
b) What is the degree of hardness of water? How are scales formed in boiler? Explain briefly the chemical oxygen demand and its consequences with reference to water pollution. [1+1.5+2.5]
8. What are nanofibers? Mention their applications in health and environment. [2+3]

9. a) Write the preparation and uses of polymethyl methacrylate (PMMA). Explain the mechanism of cationic polymerization reaction taking suitable example. [2+3]
b) Write the preparation and applications of Kevlar and polyurethane. [2.5+2.5]

OR

- i) What are carbon fiber reinforced plastics? Show your acquaintance to collagen. [1+2]
ii) Write the hydration of cement. [2]
10. a) What are the requisites of a good paint? Discuss about the impact of paint on a human health.
b) How can TNG be prepared? Write its uses. [3+2]
