

**FACULTY OF ENGINEERING & INFORMATICS**  
**B.E. I - Year (Suppl.) Examination, January 2015**

**Subject : Engineering Chemistry**

Time : 3 Hours

Max. Marks: 75

**Note: Answer all questions of Part - A and answer any five questions from Part - B.**

**PART – A (25 Marks)**

- 1 Differentiate reversible process from irreversible process and give conditions. (3)
- 2 Derive expression for variation of free energy with temperature and pressure. (3)
- 3 Describe the construction and working of Calomel electrode. (3)
- 4 Define emf and give the general expression for emf of a galvanic cell and explain the link between emf and cell reaction. (3)
- 5 Write a note on Ni-Cd battery. (3)
- 6 Explain reverse osmosis with diagram. (2)
- 7 Write the chemical equations for preparation of polyurethane. (2)
- 8 What is biodegradable polymer? Discuss the significance with an example? (2)
- 9 Differentiate primary battery from secondary battery. (2)
- 10 Explain cetane rating. (2)

**PART – B (50 Marks)**

- 11 (a) Give combined expression of I law and II law of thermodynamics and derive the conditions of equilibrium and spontaneity from it in terms  $\Delta S$ ,  $\Delta A$  and  $\Delta G$ . (7)
- (b) Two moles of an ideal gas are compressed isothermally at  $100^\circ\text{C}$  and reversibly from a pressure of 10 to 25 atm. Find the value of  $\Delta G$ . (3)
- 12 (a) Explain the principle, method and applications of conductometric titrations. (7)
- (b) Consider the cell  $\text{Ag}/\text{AgBr(s)}/\text{Br}^- (\text{M} = 0.32) \parallel \text{Cu}^{2+} (\text{M} = 0.42) / \text{Cu(s)}$  the emf of the cell at  $25^\circ\text{C}$  is 0.565 volts. Write the cell reaction and calculate standard emf of the cell. (3)
- 13 (a) Discuss the Dry corrosion and wet corrosion with their reactions with reference to iron. (6)
- (b) Discuss the boiler scales with causes and effects. (4)
- 14 (a) What are conducting polymers? Discuss the mechanism of conduction in intrinsic and extrinsic conducting polymers with one example for each type. (6)
- (b) Discuss the applications of nano materials with reference to carbon nanotubes. (4)
- 15 (a) Explain fractional distillation of petroleum and discuss the composition and significance of fractions obtained from the above fractionation. (6)
- (b) Discuss the significance of cracking and give flow diagram for catalytic cracking. (4)
- 16 (a) Derive Gibbs Helmholtz equation and discuss its applications. (5)
- (b) What is alkalinity of water? Give its determination and discuss the expressions for various alkalinities of water in terms of phenolphthalein alkalinity and total alkalinity? (5)
- 17 (a) What is electrochemical series? Discuss its applications. (4)
- (b) Discuss ultimate analysis of coal and its significance. (6)

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15. a) Write short notes on (i) Viscosity index (ii) saponification Value and (iii) Iodine value. 5  
b) What is triple point? Explain the phase diagram of water system. 5
16. a) Represent the following electrodes and write their reactions for redox process and mention their S.R.P. Values. 5  
(i) Saturated calomel electrode and (ii) Quinhydrone electrode  
b) What is the principle of EDTA titration? Briefly explain the estimation of hardness of water by EDTA method. 5
17. a) What is latex? How is natural rubber isolated from it? What is Vulcanization? How does it improve the property of natural rubber? 6  
b) Explain the principles of green chemistry. 4

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**FACULTY OF TECHNOLOGY****B.Tech. (Bridge Course) II - Semester (Backlog) Examination, April 2016****Subject: Engineering Chemistry****Time : 3 Hours****Max. Marks: 75****Note: Answer all questions from Part-A and answer any five questions from Part-B.****PART – A (25 Marks)**

- 1 Define standard electrode potential. Give its significance. (3)
- 2 What is galvanic corrosion? Explain with an example. (3)
- 3 What are the requirements of a good Fuel? (3)
- 4 Define octane number of a fuel. Give its significance. (3)
- 5 What are the conditions of precipitation? (3)
- 6 Draw the structures of chair and boat form of cyclohexane. (2)
- 7 Draw the D & L configuration of glyceraldehyde. (2)
- 8 Write the reactions for the formation of glucosazone. (2)
- 9 What are essential amino acids? Give two examples. (2)
- 10 What are proteins? Explain with an example. (2)

**PART – B (50 Marks)**

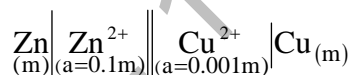
- 11 (a) Define corrosion. Explain the mechanism of electrochemical corrosion. (6)  
(b) Explain the corrosion control method by sacrificial anodic protection. (4)
- 12 (a) What are chemical fuels? Give their classification with examples. (4)  
(b) Describe the fractional distillation of crude petroleum with a well labeled diagram. (6)
- 13 (a) Discuss the principle, method and applications of complexometric titration. (6)  
(b) What are enantiomers and diastereomers? Explain with an example. (4)
- 14 (a) Write a note on Bayer's strain theory and its importance. (6)  
(b) What are sequence rule for R & S configuration? (4)
- 15 (a) What are the evidences for open chain and cyclic structure of D (+) Glucose. (5)  
(b) Give any two methods of synthesis of amino acids. (5)
- 16 (a) Describe the method of analysis of flue gases by Orsat apparatus. (6)  
(b) What is electrochemical series? Give its applications. (4)
- 17 (a) What are peptides? Explain the determination of structure of peptides. (6)  
(b) What is Waterline and Soil corrosion? Explain. (4)

**FACULTY OF ENGINEERING****B.E. I-Year (Main) Examination, April 2016****Subject : Engineering Chemistry****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

- 1 Represent Quinhydrone electrode and write the electrodic reaction for reduction process. 2
- 2 Draw the e.m.f. vs volume of titrant plot for i) strong acid vs strong base  
ii)  $\text{Fe}^{2+}$  vs  $\text{KMnO}_4$ . 3
- 3 Explain the mechanism of electrochemical corrosion. 3
- 4 What is break-point chlorination? Explain briefly. 2
- 5 Define addition and condensation polymers with suitable examples. 3
- 6 Explain the mechanism of conduction in polyacetylene. 2
- 7 What are the requirements of a good fuel? 2
- 8 What is trans estrification? Explain. 3
- 9 Define saponification number and mention its significance. 2
- 10 Write the principles of Green chemistry. 3

**PART – B (50 Marks)**

- 11 a) Calculate the e.m.f. of the following cell at  $25^\circ\text{C}$ . 5



$$\left( E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}, E_{\text{Cu}^{2+}/\text{Cu}}^0 = +0.34\text{V} \right)$$

- b) Explain the construction, working and applications of Lithium-ion batteries. 5
- 12 a) Discuss the factors that affecting the rate of corrosion. 6
- b) What are paints? Explain the constituents of a paint and mention their functions. 4
- 13 a) Explain the preparation, properties and applications of Bakelite. 6
- b) What are fibre reinforced composites? What are the advantages of such materials? 4
- 14 a) What are gross and net calorific value of a fuel? How would you express them in the case of gaseous fuel? 5
- b) How do you determine the calorific value of gaseous fuels by Junkers calorimeter? Explain. 5



- 2 -

- 15 a) Classify liquid crystals and explain their applications. 5  
b) Discuss the phase diagram of water system. 5
- 16 a) Define the term single electrode potential and derive the Nernst equation. 5  
b) How do you determine the temporary and permanent hardness of water by EDTA method? Explain. 5
- 17 a) Write the differences between thermoplastics and thermosetting resins. 4  
b) A sample of coal was found to contain the following constituents : C = 81% ; O = 8% ; S = 1% ; H = 5% ; N = 1% ; ash = 4%. Calculate the minimum amount of air required for the complete combustion of 1 kg of coal. Also calculate the percentage composition by weight of the dry products of combustion. Oxygen in air is 23% by weight. 6

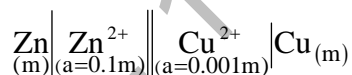
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**FACULTY OF ENGINEERING****B.E. I-Year (Main) Examination, April 2016****Subject : Engineering Chemistry****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

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- 2 Draw the e.m.f. vs volume of titrant plot for i) strong acid vs strong base  
ii)  $\text{Fe}^{2+}$  vs  $\text{KMnO}_4$ . 3
- 3 Explain the mechanism of electrochemical corrosion. 3
- 4 What is break-point chlorination? Explain briefly. 2
- 5 Define addition and condensation polymers with suitable examples. 3
- 6 Explain the mechanism of conduction in polyacetylene. 2
- 7 What are the requirements of a good fuel? 2
- 8 What is trans estrification? Explain. 3
- 9 Define saponification number and mention its significance. 2
- 10 Write the principles of Green chemistry. 3

**PART – B (50 Marks)**

- 11 a) Calculate the e.m.f. of the following cell at  $25^\circ\text{C}$ . 5



$$\left( E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}, E_{\text{Cu}^{2+}/\text{Cu}}^0 = +0.34\text{V} \right)$$

- b) Explain the construction, working and applications of Lithium-ion batteries. 5
- 12 a) Discuss the factors that affecting the rate of corrosion. 6
- b) What are paints? Explain the constituents of a paint and mention their functions. 4
- 13 a) Explain the preparation, properties and applications of Bakelite. 6
- b) What are fibre reinforced composites? What are the advantages of such materials? 4
- 14 a) What are gross and net calorific value of a fuel? How would you express them in the case of gaseous fuel? 5
- b) How do you determine the calorific value of gaseous fuels by Junkers calorimeter? Explain. 5

- 2 -

- 15 a) Classify liquid crystals and explain their applications. 5  
b) Discuss the phase diagram of water system. 5
- 16 a) Define the term single electrode potential and derive the Nernst equation. 5  
b) How do you determine the temporary and permanent hardness of water by EDTA method? Explain. 5
- 17 a) Write the differences between thermoplastics and thermosetting resins. 4  
b) A sample of coal was found to contain the following constituents : C = 81% ; O = 8% ; S = 1% ; H = 5% ; N = 1% ; ash = 4%. Calculate the minimum amount of air required for the complete combustion of 1 kg of coal. Also calculate the percentage composition by weight of the dry products of combustion. Oxygen in air is 23% by weight. 6

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**FACULTY OF ENGINEERING & INFORMATICS****B.E. I – Year (Common to all) (Suppl.) Examination, December 2013****Subject : Engineering Chemistry****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

1. What is state function? Explain with an example. 2
2. Differentiate between Gibbs and Helmholtz free energy. 3
3. Define ionic mobility and transport number. Give the interrelationship between them. 3
4. Distinguish between primary and secondary battery. 2
5. What is corrosion of metals? What are its causes? 3
6. Explain the disadvantages of hard water. 2
7. What is copolymerization? Explain with an example. 3
8. What are the advantages of vulcanized rubber? 2
9. Write a note on LPG and CNG. 3
10. Explain the mechanism of conduction in conducting polymers. 2

**PART – B (50 Marks)**

- 11.a) Compare the work done in isothermal and adiabatic reversible expansion. 4
- b) One mole of an ideal mono-atomic gas expands reversibly from a volume of  $10 \text{ dm}^3$  at 298 K to a volume of  $20 \text{ dm}^3$  at 250 K. Calculate the change in entropy for this process ( $C_v = 3/2 R$ ). 6
- 12.a) Define specific and equivalent conductance of an electrolyte. Explain the method of their measurement. 5
- b) A conductance cell has two platinum electrodes of  $1.50 \text{ square cm}$  area placed at  $10.50 \text{ cm}$  apart, placed in an electrolytic solution. The resistance of the solution was found to be  $200 \text{ ohms}$ . Calculate the cell constant, and specific conductance of the electrolytic solution. 5
- 13.a) Explain the different types of electrochemical corrosion. 5
- b) What are the different corrosion control methods? Explain any two of them. 5
- 14.a) Explain the differences between thermoplastics and thermosetting polymers. 4
- b) Give the preparation, properties and uses of the following : 6
  - i) Bakelite
  - ii) Nylon – 6, 6
  - iii) Buna-S rubber
- 15.a) Define calorific value of a fuel. Distinguish between Higher and Lower calorific value of a fuel. 3
- b) What is cracking of petroleum? Give its significance. 3
- c) Calculate the weight of air required for the combustion of  $3 \text{ kg}$  of coal containing  $80\% \text{ C}$ ,  $8\% \text{ H}$ ,  $3\% \text{ O}$ ,  $4\% \text{ S}$  and remaining ash. 4
- 16.a) What is Hardness of water? How will you determine the hardness of water by EDTA method. 6
- b) A sample of water contains the following dissolved salts :  
 $\text{Ca}(\text{HCO}_3)_2 = 20 \text{ mg/L}$ ,  $\text{Mg}(\text{HCO}_3)_2 = 17.5 \text{ mg/L}$ ,  $\text{MgCl}_2 = 12 \text{ mg/L}$ ,  
 $\text{CaCl}_2 = 22.2 \text{ mg/L}$  and  $\text{CaSO}_4 = 28 \text{ mg/L}$ . Calculate the temporary and permanent hardness of water. 4
- 17.a) Write a note on types of electrodes. 6
- b) Calculate the emf of a Daniel cell at  $25^\circ\text{C}$ , when the concentration of  $\text{ZnSO}_4$  and  $\text{CuSO}_4$  are  $0.01 \text{ M}$  and  $0.1 \text{ M}$  respectively. The standard potential of the cell is  $1.10 \text{ V}$ . 4

**FACULTY OF ENGINEERING AND INFORMATICS**  
**B.E. I Year (Common to all Branches) (Supplementary)**  
**Examination, Dec. 2009/Jan. 2010**  
**ENGINEERING CHEMISTRY**

Time: 3 Hours]

[Max. Marks: 75

*Note : Answer all questions of Part A.**Answer five questions of Part B.***PART – A****(25 Marks)**

1. What happens to the internal energy of a system, if work is done i) by the system, ii) on the system ? 2
2. Calculate the change in entropy accompanying the isothermal expansion of 5 moles of an ideal gas to 6 times to its initial volume at 330 K. 3
3. Why does the equivalent conductance increases with dilution ? 2
4. Describe the construction of standard hydrogen electrode. 3
5. Why does corrosion of water filled steel tanks occur below the waterline ? 3
6. What are the salts responsible for the temporary and permanent hardness of water ? 2
7. Differentiate between homopolymer and copolymer. 2
8. Why does raw rubber need vulcanization ? 3
9. What is octane number ? What is its significance ? 2
10. Calculate the minimum weight of air required for complete combustion of 1 kg of fuel containing : C = 90%, H = 3.5 % ; O = 3% and rest is ash. 3



## PART – B

(50 Marks)

11. a) Derive a Clausius-Clapeyron, equation. What are its applications ? 7  
 b) An ideal gas expands reversibly and isothermally from a volume of 10 lit. to 20 lit. at 27°C. Calculate the  $\Delta E$ ,  $q$  and  $w$ . 3
12. a) Describe the construction of calomel electrode. 4  
 b) What is the effect of dilution on specific conductance and equivalent conductance ? 2  
 c) A zinc rod is placed in 0.01 M  $\text{ZnSO}_4$  solution at 298 K. Write the electrode reaction and calculate the potential of the electrode  $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}$ . 4
13. a) What is corrosion ? Describe the mechanism of electrochemical corrosion. 6  
 b) Describe the softening of water by ion-exchange method. 4
14. a) Write preparation, properties and uses of (a) PVC (b) Buna-N. 6  
 b) Differentiate between thermoplastics and thermosetting resins. 4
15. a) Describe the analysis of coal by proximate analysis. 6  
 b) Describe the determination of calorific value by Bomb calorimeter. 4
16. a) Differentiate between isothermal process and adiabatic process. 2  
 b) Discuss the entropy change in reversible and irreversible processes. 4  
 c) Write a note on break point chlorination. 4
17. a) Describe the construction of lead-acid battery with the reactions occurring during charging and discharging. 6  
 b) Describe the principle of strong acid-strong base conductometric titration. 4

## FACULTY OF ENGINEERING &amp; INFORMATICS

B.E. (I-Year) (Common to all Branches) (Supplementary) Examination, January 2011

## ENGINEERING CHEMISTRY

Time : Three Hours]

[Maximum Marks : 75

*Answer ALL questions of Part A, at one place in the Answer Book.**Answer FIVE questions from Part B.*

## PART—A (Marks : 25)

1. Differentiate between Reversible and Irreversible processes. 2
2. Explain Gibbs Free energy function and its importance. 2
3. What are co-polymers ? Give two examples. 2
4. Why the calomel is used as reference electrode in place of the standard hydrogen electrode ? 2
5. A sample of water contains 21.9 mg of magnesium bicarbonate, 19.0 mg of magnesium chloride, 33 mg of calcium chloride and 18 mg of magnesium sulphate per litre. Calculate the temporary and permanent hardness of this sample. (Atomic weights of Mg = 24, Ca = 40, S = 32, Cl = 35.5) 3
6. Give the equation for the preparation of :
  - (i) Styrene-butadiene rubber
  - (ii) Neoprene rubber. 3
7. State and explain Kohlrausch's law of independent migration of ions. 3
8. How is the corrosion of a metal prevented by sacrificial anodic method ? 2
9. What is meant by calorific value of a fuel ? Give the units of calorific value of the gaseous fuel. 3
10. Write charging and discharging reactions of the lead-acid battery. 3

## PART—B (Marks : 50)

11. (a) Obtain an expression relating T and V in an adiabatic reversible expansion of a gas obeying the equation of state  $PV = nRT$ .
- (b) One mole of an ideal gas at 300 K is compressed isothermally under external pressure of 200 atm. Calculate the quantities q, w,  $\Delta H$  and  $\Delta E$ , if the initial and final pressure of the gas is 2.0 atm and 100 atm respectively.



12. (a) Explain the effect of dilution on specific and equivalent conductance.
- (b) Conductivity of 0.02 N KCl at 298 K is  $2.768 \times 10^{-3} \text{ s. cm}^{-1}$ . It offers a resistance of 82.4 ohm in a given cell. Using the same cell 0.005 N offers a resistance of 32.4 ohm. Find the following (i) Cell constant, (ii) Equivalent and (iii) Specific conductance.
13. (a) Explain the principle involved in the potentiometric acid-base titrations (strong acid vs strong base) using calomel and quinhydrone electrodes.
- (b) Derive Gibbs-Helmholtz equation and discuss its applications.
14. (a) Explain addition, condensation and co-polymerisation processes with examples.
- (b) Differentiate between thermoplastics and thermosetting resins with examples.
15. (a) What are boiler troubles and explain preventive measures.
- (b) Explain the octane and cetane numbers of a fuel. Discuss their significance.
16. (a) Write notes on :
- (i) Galvanization
- (ii) Galvanic corrosion.
- (b) Give the preparation, properties and uses of :
- (i) Nylon 66
- (ii) PVC.
17. (a) How calorific value of fuel is determined by Bomb Calorimeter ?
- (b) What are conducting polymers ? Mention any four applications of conducting polymer.



- 15 a) Classify liquid crystals and give suitable example for each. 5  
b) Define the terms:  
i) Phase  
ii) Component 5
- 16 a) Explain the principle and applications of potentiometric titrations. 5  
b) Write the electrode representation and electrodic reaction for the reduction process of  
i) Calomel electrode and  
ii) Quinhydrone electrode 5
- 17 a) What is phenolphthalien and methyl orange alkalinity of water? Explain. 5  
b) Give one example each for 5  
i) Addition polymer  
ii) Condensation polymer  
iii) Co-polymer  
and give their structure

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**FACULTY OF ENGINEERING & INFORMATICS****B.E. I – Year (New) (Suppl.) Examination, January 2016****Subject: Engineering Chemistry****Time: 3 Hours****Max.Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 Define single electrode potential. 2
- 2 What is a battery? Give one example each for primary and secondary batteries. 3
- 3 Explain sacrificial anodic method of protecting corrosion. 3
- 4 Define the term "Reverse osmosis" and what is its use. 2
- 5 Write the structure of Bakelite. 2
- 6 What is conducting polymer? Give one example. 3
- 7 Define the terms:
  - i) HCV and
  - ii) LCV of a fuel. 2
- 8 Explain various sources of Bio Diesel. 3
- 9 What is Pattinson's process? Explain. 3
- 10 Define:
  - i) Saponification number and
  - ii) Acid value. 2

**PART – B (5x10 = 50 Marks)**

- 11 a) Construct a cell for the reaction
 
$$\text{Fe} + \text{Ni}^{2+} \rightarrow \text{Fe}^{2+} + \text{Ni}$$

(s) (0.1m) (0.01m) (s)

Calculate the e.m.f. of the cell at 25°C from the following S.R.P. values data

$$E_{\text{Fe}^{2+}/\text{Fe}}^{\circ} = -0.440 \text{ V and } E_{\text{Ni}^{2+}/\text{Ni}}^{\circ} = -0.250 \text{ V}$$

Is the cell reaction spontaneous or not? 5

b) Discuss the construction, working and applications of Nickel-Cadmium battery. 5
- 12 a) Explain:
  - i) Galvanic corrosion
  - ii) Electroplating. 5

b) Describe ion-exchange method of softening of water. 5
- 13 a) Write the preparation and properties of
  - i) Poly urethane and
  - ii) Buna – S rubber. 6

b) Discuss the applications of conducting polymers. 4
- 14 a) What is meant by cracking of petroleum? Describe moving bed catalytic cracking method used for cracking of petroleum. 6
- b) Write the characteristics of a good propellant. 4

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**FACULTY OF ENGINEERING****B.E. I – Year (New) (Main) Examination, June / July 2015****Subject: Engineering Chemistry****Time: 3 Hours****Max. Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 Represent Calomel electrode and write the electrodic reaction for reduction process and mention the S.R.P. value of the electrode. 3
- 2 Draw the conductometric titration plot of weak acid against strong base and explain the graph.
- 3 What is waterline corrosion? Explain. 3
- 4 Name three substances used for sterilization of water. 2
- 5 Define the term “functionality” of monomers. Explain its significance with a suitable example. 2
- 6 Explain the types of composite materials. 3
- 7 Define octane number. How will you improve the anti-knocking value of fuel? 3
- 8 Classify rocket fuels. 2
- 9 Define phase and component. 2
- 10 Classify lubricants and give one example each. 3

**PART – B (5x10 = 50 Marks)**

- 11 a) For the cell reaction  $Zn(s) + Fe^{2+} \rightleftharpoons Zn^{2+} + Fe(s)$ . Calculate the reactive concentration of  $Zn^{2+}$  and  $Fe^{2+}$  at which the overall cell E.M.F. becomes zero.  
 $E_{Fe^{2+}/Fe}^{\circ} = -0.440\text{ V}$  and  $E_{Zn^{2+}/Zn}^{\circ} = -0.760\text{ V}$ . 6
- b) Explain hydrogen – oxygen fuel cell. 4
- 12 a) Define metallic corrosion. Explain electrochemical theory of corrosion. 6
- b) What are the characteristics of a paint? Name the various constituents of paints. 4
- 13 a) Differentiate between homopolymer and co-polymer. 4
- b) What are conducting polymers? Discuss the applications of conducting polymers. 6
- 14 a) What are chemical fuels? How are they classified? Give suitable examples for each class.
- b) A gaseous fuel has the following composition by volume:  $H_2 = 25\%$ , methane = 30%, ethane = 11%, ethylene = 4.5%, butane = 2.5%, CO = 6.0%,  $CO_2 = 8\%$ ,  $O_2 = 2\%$  and  $N_2 = 12\%$ . Calculate the air fuel ratio and volumetric analysis of dry products of combustion using 40% excess air. 6
- 15 a) Write the principles of Green Chemistry. 5
- b) Draw a neat diagram of water system and label the parts. Calculate the degree of freedom at triple point. 5
- 16 a) Derive Nernst equation. 4
- b) Differentiate between potentiometric titrations and pH metric titrations by taking a suitable example like HCl Vs NaOH. 6
- 17 a) How do you determine the permanent hardness of water by EDTA method? Explain. 5
- b) Explain the mechanism of extreme-pressure lubrication. 5

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## FACULTY OF ENGINEERING

B.E. I<sup>st</sup> Year (Common to all Branches) Regular (Main) Examination,

May/June, 2009

## ENGINEERING CHEMISTRY

Time : 3 Hours]

[Max. Marks : 75

Answer **all** questions of Part A at One Place in the answer book.Answer **five** questions from Part B.**Part A – (Marks : 25)**

1. What is an extensive property? Give an example? 2
2. Give any two statements of second Law of Thermodynamics. 2
3. The specific conductivity of 0.5 N solution of an electrolyte at 25° C is 0.02 ohm cm<sup>-1</sup>. Calculate the resistance offered by this solution when taken in a conductivity cell with two platinum electrodes 2.1 cm apart and 4.2 cm<sup>2</sup> in area. 3
4. What is <sup>absolute ionic</sup> mobility? Give its units? 2
5. Write a brief note on galvanic corrosion. 3
6. Define hardness of water? Why do we express hardness in terms of Ca CO<sub>3</sub>. 3
7. Give equations for the preparation of
  - (i) Buna S
  - (ii) Butyl Rubber
8. Distinguish between thermoplastics and thermosettings with examples. 2
9. Calculate the weight of air (23% oxygen by weight) required for the complete combustion of 16kg of methane. 3
10. What is octane number? What is its significance? 2

**Part B – (5 × 10 = 50 Marks)**

11. (a) Differentiate between
  - (i) Reversible and Irreversible process
  - (ii) Isothermal and Adiabatic process.
- (b) A given was of perfect gas at 0°C is compressed suddenly to a pressure of 20 times the initial value, calculate the final temperature of the gas (Given  $\gamma = 1.42$ )



12. (a) Define the terms.
- (i) Specific conductance
  - (ii) Equivalent Conductance.
- (b) What is the effect of dilution on them of an electrolyte calculate the single electrode potential of copper metal in contact with 0.1 molar copper sulphate solution. The standard electrode potential for  $\text{Cu}^{+2} / \text{Cu}$  is 0.34 V.
13. (a) Describe briefly the estimation of hardness of water sample by the EDTA method.
- (b) Explain how the rate of corrosion of a metal is affected by the following factor
- (i) Nature of the corrosion product
  - (ii) Ratio of anodic to cathodic areas.
14. (a) Write notes on the structure, method of preparation, properties and uses of the following
- (i) Bakelite.
  - (ii) Teflon.
- (b) Why natural rubber needs vulcanization.
15. (a) Describe the determination of calorific value of solid fuel by Bomb calorimeter
- (b) Write short notes on
- (i) Classification of fuels.
  - (ii) Cracking and its significance.
16. (a) Describe the construction of Lead-acid battery with the reaction occurring during discharging and charging.
- (b) Derive the Gibbs- Helmholtz equation.
17. (a) What is electrochemical series ? Discuss its application.
- (b) What are the limitations of first law of thermodynamics?

**FACULTY OF ENGINEERING & INFORMATICS****B.E. I Year (New) (Common to all branches) (Main) Examination, June 2011****ENGINEERING CHEMISTRY****Time : 3 Hours ]****[ Max. Marks : 75****Note :** Answer **all** questions from Part – A. Answer any **five** Questions from Part – B.**PART – A****(Marks : 25)**

1. What is Quinhydrone electrode ? Write the reduction electrode reaction of it. 2
2. Write a short note on Ni-Cd battery. 3
3. Differentiate between Gibb's and Helmholtz free energy. 2
4. State phase rule and explain the terms involved. 3
5. What are boiler troubles ? How are they prevented ? 3
6. Write a short note on differential aeration corrosion. 2
7. Distinguish between addition and condensation polymerization. 3
8. Write the applications of Carbon nanotubes. 2
9. What are the requirements of a good fuel ? 3
10. Define octane and cetane number of a fuel. 2

**PART – B****(Marks : 50)**

11. (a) What is electrochemical series ? Give its applications with suitable examples. 5  
 (b) Describe the construction of lead-acid battery with the reactions occurring during discharge. 5
12. (a) What is Carnot cycle ? Derive an expression for the efficiency of Carnot engine. 6  
 (b) The temperature of 1 mole of an ideal gas increases from 18 °C to 55 °C as the gas is compressed adiabatically. Calculate the work done and  $\Delta H$  for this process assuming that  $C_v = \frac{3}{2}R$ . 4
13. (a) Differentiate between chemical and electrochemical corrosion. 4  
 (b) Discuss the various factors that influence the rate of corrosion. 6
14. (a) What are plastics, fibres and elastomers ? Give one example to each. 4  
 (b) What is vulcanization of rubber ? What are its advantages over raw rubber ? 3  
 (c) Give the applications of conducting polymers. 3



15. (a) Differentiate between High and Low calorific value of a fuel. 2  
(b) Explain proximate analysis of coal. What is its importance ? 4  
(c) Write a short note on LPG and CNG. 4
16. (a) Explain the principle and procedure involved in potentiometric acid-base titrations. 4  
(b) 2 mole of an ideal gas expands isothermally from a volume of 10 litres to 20 litres at 27 °C. Calculate the entropy change in the process. 3  
(c) Distinguish between temporary and permanent hardness of water. 3
17. (a) Give the preparation, properties and uses of the following : 4  
(i) PVC  
(ii) Perlon-U  
(b) What is the principle of Rocket propulsion ? 2  
(c) 100 ml of a water sample required 20 ml of  $\frac{N}{50}$   $H_2SO_4$  for neutralization to phenolphthalein end point. After this, methyl orange indicator was added to this and further acid required was 15 ml. Calculate the type and amount of alkalinity of water. 4

## FACULTY OF ENGINEERING &amp; INFORMATICS

B.E. I Year (Common to all branches) Examination, May/June 2012

## ENGINEERING CHEMISTRY

Time : 3 Hours]

[Max. Marks : 75

Answer **all** questions from Part-A.Answer any **five** questions from Part-B.**Part A** — (Marks : 25)

1. Describe the construction of standard hydrogen electrode. 3
2. Explain the principle involved in the conductometric titration of strong acid with a strong base. 2
3. Differentiate between reversible and irreversible processes. 3
4. A heat engine working between  $0^{\circ}\text{C}$  and  $100^{\circ}\text{C}$  takes up 840 Joules from the high temperature reservoir. Calculate the work done and the efficiency. 2
5. In a structure, two dissimilar metals should not be allowed to come in contact with each other. Why? 2
6. What is reverse osmosis? How is this process help in softening of water? 3
7. Differentiate between addition and condensation polymerisation with suitable examples. 3
8. Write any two advantages of composite materials. 2
9. What is octane number? What is its significance? 2
10. What is Rocket Propellant? Write any four characteristics of a good propellant. 3

**Part B** – (Marks: 50)

11. (a) Describe the construction of lead-acid battery with the reactions occurring during discharging and charging. 6
- (b) Derive Nernst equation for single electrode potential. What are its applications? 4



12. (a) Explain change of entropy in reversible and irreversible processes. 4  
(b) Derive Gibbs-Helmholtz equation. What are its applications? 6
13. (a) What is Cathodic protection? Explain sacrificial anode method. 4  
(b) What is disinfection of drinking water? Explain break point chlorination. 4  
(c) 50 ml. of a standard hard water consumed 15 ml. of 0.01 M EDTA solution. 50 ml. of a water sample consumed 25 ml. of same EDTA solution. Calculate the total hardness of water sample. 2
14. (a) Write preparation, properties and uses of : 6  
(i) Teflon  
(ii) Buna-5  
(b) What are conducting polymers ? Discuss the classification of conducting polymers. 4
15. (a) What is Cracking? Describe the catalytic cracking by fixed bed method. 5  
(b) What is CNG? What is its composition? What are the advantages of CNG as a fuel? 5
16. (a) Draw and explain phase diagram for water system. 6  
(b) Calculate the EMF of a Daniel cell at  $25^{\circ}\text{C}$ , when the concentration of  $\text{ZnSO}_4$  and  $\text{CuSO}_4$  are 0.001 M and 0.1 M respectively. The standard electrode potential of copper and zinc electrodes are 0.34 V and - 0.76 V respectively. 4
17. (a) What are the factors affecting the rate of corrosion? 5  
(b) What is Vulcanization? What is its significance? 3  
(c) Give any four important applications of nanomaterials. 2

## FACULTY OF ENGINEERING &amp; INFORMATICS

B.E. I Year (Main) (Common to All Branches) Examination, June 2013

Subject: Engineering Chemistry

Time: 3 Hours

Max.Marks: 75

*Note : Answer all questions from Part A. Answer any Five questions from Part B.***PART – A (25 Marks)**

1. Electrode potential of zinc is assigned a negative value, whereas that of copper a positive value. Give reason. (2)
2. Construct calomel electrode with electrode notation and electrode reaction. (3)
3. What are the limitations of I law of thermodynamics? (3)
4. One mole of an ideal gas expands from 10 lit. to 25 lit. at 25°C. Calculate the change in free energy of the process. (2)
5. Differentiate between anodic and cathodic coatings. (2)
6. Explain break point chlorination. (3)
7. Differentiate between thermoplastics and thermosetting resins. (3)
8. What are composites? What are their advantages? (2)
9. What is cracking? What is its significance? (3)
10. Calculate the minimum amount of air required for complete combustion of 1 kg of fuel containing: C = 90%, H = 3.5%, O = 3%, N = 1% and rest ash. (2)

**PART – B (50 Marks)**

- 11.(a) What is primary battery? Describe the construction and working of zinc-carbon battery with relevant reactions occurring during discharge. (6)
- (b) Discuss the principle involved in the potentiometric acid-base titrations. (4)
- 12.(a) What is isothermal process? Derive an equation for the work done in isothermal reversible process. (5)
- (b) Discuss the conditions of equilibrium and spontaneity in terms of free energy. (5)
- 13.(a) Explain electrochemical corrosion with mechanism. (6)
- (b) Describe the softening of water by ion-exchange method. (4)
- 14.(a) Write preparation, properties and uses of (i) PVC and (ii) butyl rubber. (6)
- (b) Define Homo, Hetero and copolymers with suitable examples. (4)
- 15.(a) What are the characteristics of a good propellant? (4)
- (b) What is calorific value of fuel? Describe the determination of calorific value of fuel by Bomb calorimeter. (6)
- 16.(a) What is a cyclic process? Describe the carnot cycle for establishing the maximum convertibility of heat into work. (6)
- (b) 2 Moles of an ideal gas expands reversibly and isothermally from a volume of 10 lit. to a volume of 20 lit at 27°C. Calculate the q, w, and  $\Delta E$  for the process. (4)
- 17.(a) what is paint? What are its constituents and their functions? (6)
- (b) What is cetane number? What is its significance? (2)
- (c) Write any three applications of conducting polymers. (2)

- 15 a) Classify liquid crystals and give suitable example for each. 5  
b) Define the terms:  
i) Phase  
ii) Component 5
- 16 a) Explain the principle and applications of potentiometric titrations. 5  
b) Write the electrode representation and electrodic reaction for the reduction process of  
i) Calomel electrode and  
ii) Quinhydrone electrode 5
- 17 a) What is phenolphthalien and methyl orange alkalinity of water? Explain. 5  
b) Give one example each for 5  
i) Addition polymer  
ii) Condensation polymer  
iii) Co-polymer  
and give their structure

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**FACULTY OF ENGINEERING & INFORMATICS****B.E. I – Year (New) (Suppl.) Examination, January 2016****Subject: Engineering Chemistry****Time: 3 Hours****Max.Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 Define single electrode potential. 2
- 2 What is a battery? Give one example each for primary and secondary batteries. 3
- 3 Explain sacrificial anodic method of protecting corrosion. 3
- 4 Define the term "Reverse osmosis" and what is its use. 2
- 5 Write the structure of Bakelite. 2
- 6 What is conducting polymer? Give one example. 3
- 7 Define the terms:
  - i) HCV and
  - ii) LCV of a fuel. 2
- 8 Explain various sources of Bio Diesel. 3
- 9 What is Pattinson's process? Explain. 3
- 10 Define:
  - i) Saponification number and
  - ii) Acid value. 2

**PART – B (5x10 = 50 Marks)**

- 11 a) Construct a cell for the reaction
 
$$\text{Fe} + \text{Ni}^{2+} \rightarrow \text{Fe}^{2+} + \text{Ni}$$

(s) (0.1m) (0.01m) (s)

Calculate the e.m.f. of the cell at 25°C from the following S.R.P. values data

$$E_{\text{Fe}^{2+}/\text{Fe}}^{\circ} = -0.440 \text{ V and } E_{\text{Ni}^{2+}/\text{Ni}}^{\circ} = -0.250 \text{ V}$$

Is the cell reaction spontaneous or not? 5

b) Discuss the construction, working and applications of Nickel-Cadmium battery. 5
- 12 a) Explain:
  - i) Galvanic corrosion
  - ii) Electroplating. 5

b) Describe ion-exchange method of softening of water. 5
- 13 a) Write the preparation and properties of
  - i) Poly urethane and
  - ii) Buna – S rubber. 6

b) Discuss the applications of conducting polymers. 4
- 14 a) What is meant by cracking of petroleum? Describe moving bed catalytic cracking method used for cracking of petroleum. 6
- b) Write the characteristics of a good propellant. 4

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**FACULTY OF ENGINEERING****B.E. I – Year (New) (Main) Examination, June / July 2015****Subject: Engineering Chemistry****Time: 3 Hours****Max. Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 Represent Calomel electrode and write the electrodic reaction for reduction process and mention the S.R.P. value of the electrode. 3
- 2 Draw the conductometric titration plot of weak acid against strong base and explain the graph.
- 3 What is waterline corrosion? Explain. 3
- 4 Name three substances used for sterilization of water. 2
- 5 Define the term “functionality” of monomers. Explain its significance with a suitable example. 2
- 6 Explain the types of composite materials. 3
- 7 Define octane number. How will you improve the anti-knocking value of fuel? 3
- 8 Classify rocket fuels. 2
- 9 Define phase and component. 2
- 10 Classify lubricants and give one example each. 3

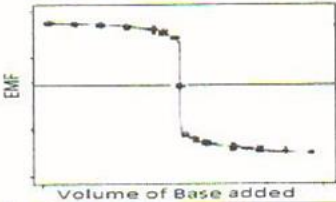
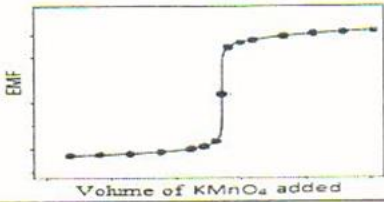
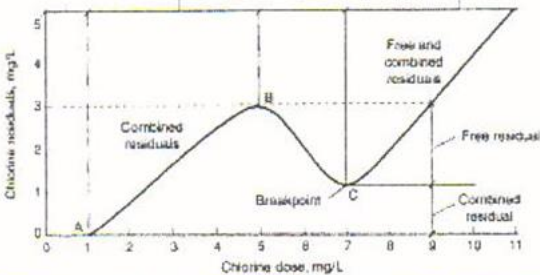
**PART – B (5x10 = 50 Marks)**

- 11 a) For the cell reaction  $Zn(s) + Fe^{2+} \rightleftharpoons Zn^{2+} + Fe(s)$ . Calculate the reactive concentration of  $Zn^{2+}$  and  $Fe^{2+}$  at which the overall cell E.M.F. becomes zero.  
 $E_{Fe^{2+}/Fe}^{\circ} = -0.440\text{ V}$  and  $E_{Zn^{2+}/Zn}^{\circ} = -0.760\text{ V}$ . 6
- b) Explain hydrogen – oxygen fuel cell. 4
- 12 a) Define metallic corrosion. Explain electrochemical theory of corrosion. 6
- b) What are the characteristics of a paint? Name the various constituents of paints. 4
- 13 a) Differentiate between homopolymer and co-polymer. 4
- b) What are conducting polymers? Discuss the applications of conducting polymers. 6
- 14 a) What are chemical fuels? How are they classified? Give suitable examples for each class.
- b) A gaseous fuel has the following composition by volume:  $H_2 = 25\%$ , methane = 30%, ethane = 11%, ethylene = 4.5%, butane = 2.5%, CO = 6.0%,  $CO_2 = 8\%$ ,  $O_2 = 2\%$  and  $N_2 = 12\%$ . Calculate the air fuel ratio and volumetric analysis of dry products of combustion using 40% excess air. 6
- 15 a) Write the principles of Green Chemistry. 5
- b) Draw a neat diagram of water system and label the parts. Calculate the degree of freedom at triple point. 5
- 16 a) Derive Nernst equation. 4
- b) Differentiate between potentiometric titrations and pH metric titrations by taking a suitable example like HCl Vs NaOH. 6
- 17 a) How do you determine the permanent hardness of water by EDTA method? Explain. 5
- b) Explain the mechanism of extreme-pressure lubrication. 5

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	<p>b) <b>Lithium Ion battery</b>  <b>Construction &amp; working:</b>  <b>Anode (-ve):</b> Porous Graphite ; <b>Cathode (+ve):</b> Lithium metal oxide (<math>\text{Li}_{1-x}\text{CoO}_2</math>)  <b>Electrolyte:</b> A mixture of organic carbonate (ethylene carbonate) containing complex (<math>[\text{LiPF}_6]</math>) of lithium ions.  Anode and cathode are separated by electrical insulating separator (diaphragm) which permeable to lithium ions.  <b>During discharging</b> Lithium ions travel, by electrolyte, from Anode (Negative electrode) to cathode (positive electrode) and transition metal Co is reduced from <math>\text{Co}^{+4}</math> to <math>\text{Co}^{+3}</math>  <b>During charging</b> lithium ions move from the positive electrode to the Negative electrode and transition metal Co is oxidised from <math>\text{Co}^{+3}</math> to <math>\text{Co}^{+4}</math>.  The electrode reactions that take place during charging and discharging can be summarized as,</p> $x\text{LiC}_6 + \text{Li}_{1-x}\text{CoO}_2 \xrightleftharpoons[\text{Charge}]{\text{Discharge}} x\text{C}_6 + \text{Li}$ <p><b>Applications:</b> As mobile phone batteries, laptop batteries, as a battery in electric cars.</p>	4
12	<p>a) <b>Factors that effecting the rate of corrosion :</b>  i) Position of the metal in Galvanic Series, ii) Relative areas of anode and cathode, iii) Nature of Corrosion product, iv) Temperature, vi) Humidity, vii) pH  Explanation</p> <p>b) <b>Paint :</b> Definition ; Main constituents with their Functions</p>	2 4 1+3
13	<p>a) <b>Bakelite:</b> Preparation ; Properties ; Applications</p> <p>b) <b>Fibre reinforced composites :</b> Definition ; Advantages</p>	3+2+1 2+2
14	<p>a) <b>HCV:</b> Definition ; <b>LCV :</b> Definition  Expression of HCV /LCV for gases:  <math>\text{Kcal/m}^3</math> or <math>\text{B.Th.U/R}^3</math> Or <math>\text{HCV} = \frac{W(T_2 - T_1)}{V} \frac{\text{Kcal}}{\text{m}^3}</math>; <math>\text{LCV} = \left[ \text{HCV} - \frac{m}{V} \times 587 \right]</math></p> <p>b) <b>Junkers calorimeter :</b> Diagram ; Explanation  Formula: <math>\text{HCV} = \frac{W(T_2 - T_1)}{V} \frac{\text{Kcal}}{\text{m}^3}</math></p>	2+2 1 2+2 1
15	<p>a) <b>Liquid crystals:</b> Classification – Thermotropic , Lyotropic;  Nematic, Smectic, Cholesteric  Applications</p> <p>b) <b>Phase diagram of water :</b> Diagram with labeling ; Explanation</p>	3 2 2+3
16	<p>a) <b>Single electrode Potential :</b> Definition ; Derivation of Nernst equation</p> <p>b) <b>EDTA Method :</b> Principle &amp; structure of EDTA ; Explanation (procedure)</p>	1+4 2+3
17	<p>a) <b>Thermoplastics and thermosets :</b> Any four differences</p> <p>b) <b>Numerical Problem:</b> <math>\text{Net } O_2 = \left[ \frac{32}{12}XC + 8X\left(H - \frac{O}{8}\right) + \frac{32}{32}XS \right]</math>  <math>= \left[ \frac{32}{12}X0.81 + \left(0.05 - \frac{0.08}{8}\right)X8 + \frac{32}{32}X0.01 \right] = 2.49\text{Kg}</math>  <math>\text{Air required} = \frac{100}{23}X \left[ \frac{32}{12}XC + \left(H - \frac{O}{8}\right)X8 + \frac{32}{32}XS \right] = 10.82 \text{ Kg}</math>  Where ,C, S, O , H are weights in kgs present in coal respectively,  <b>Percentage composition by weight of dry products of combustion</b>  <math>\text{weight of dry products} = \left[ \frac{44}{12}XC + \frac{64}{32}XS + \text{Weight of Nitrogen} \right]</math>  <math>= \left[ \frac{44}{12}X0.81\text{kg} + \frac{64}{32}X0.01\text{kg} + \text{Total weight of } N_2 \right]</math>  <math>= [2.97\text{kg} + 0.02\text{kg} + 8.32\text{kg}] = 11.31\text{kg}</math>  Where ,C, S, are weights in kg present in coal respectively,  Total Weight of Nitrogen = Weight of <math>N_2</math> present in coal + Weight of <math>N_2</math> used in the air for combustion.    <b>% Composition:</b>  <math>\text{CO}_2 = \frac{2.97}{11.31} \times 100 = 26.2\%</math>; <math>\text{SO}_2 = \frac{0.02}{11.31} \times 100 = 0.176\%</math> ; <math>N_2 = \frac{8.31}{11.31} \times 100 = 73.47\%</math></p>	4 5 1



Q.NO.	Key Points	Marks
PART-A(25Marks)		
1	<p>Representation: <math>H^+_{(aq)}/Q/QH_2/Pt</math> Or <math>Pt; Q;QH_2;H^+_{(aq)}</math></p> <p>Reduction reaction:</p> $  \begin{array}{c} \text{O} \\ \parallel \\ \text{C}_6\text{H}_4 \\ \parallel \\ \text{O} \end{array} + 2H^+ + 2e^- \longrightarrow \begin{array}{c} \text{OH} \\   \\ \text{C}_6\text{H}_4 \\   \\ \text{OH} \end{array} \quad \text{Or} \quad Q + 2H^+ + 2e^- \longrightarrow QH_2  $ <p>Quinone(Q)                      Hydroquinone(QH<sub>2</sub>)</p>	1 1
2	<p>Emf Vs Volume</p> <p>i) Strong acid Vs Strong Base</p>  <p>ii) Fe<sup>2+</sup> Vs KMnO<sub>4</sub></p> 	$1\frac{1}{2} \times 2 = 3$
3	<p>i) Wet or electro chemical corrosion occurs when a metal surface comes in contact with a conducting liquid or when two dissimilar metals are immersed or dipped partially in a solution.</p> <p>ii) Formation of anodic and cathodic areas.</p> <p>iii) Presence of conducting medium.</p> <p>iv) Corrosion of anodic parts only.</p> <p>v) Formation of Corrosion product closer to the cathodic area.</p>	3
4	<p><b>Breakpoint Chlorination:</b> It is the minimum amount of chlorine required to oxidize the oxidisable impurities, to destroy pathogens.</p> <div style="display: flex; justify-content: space-around; font-size: small;"> <div>Destruction of chlorine residual by reducing compounds</div> <div>Formation of chloro-organic and chloramine compounds</div> <div>Destruction of chloramines and chloro-organic compounds</div> <div>Formation of free chlorine and presence of chloro-organic compounds not destroyed</div> </div> 	1  1(Graph)
5	Addition Polymer: Definition & example ; Condensation Polymer: Definition & example	$1\frac{1}{2} \times 2 = 3$
6	Mechanism of Conduction of Polyacetylene:	2
7	Requirements of a good fuel : (any two): i) High calorific value, ii) Moderate ignition temperature, iii) Low moisture content, iv) should not produce harmful products like CO <sub>2</sub> , SO <sub>2</sub> , H <sub>2</sub> S and other poisonous gases.	2
8	<p><b>Trans esterification</b> – Reaction of an ester with alcohol is called trans esterification.</p> <p>Or</p> <p>The process used to convert vegetable oils/animal oils /fats to biodiesel is called trans esterification. These reactions are often <u>catalyzed</u> by the addition of an <u>acid</u> or <u>base</u>.</p> $R'OH + R''O-C(=O)-R \xrightarrow{H^+/OH^-} R'OH + R''O-C(=O)-R$	1 2
9	<p><b>Saponification Number:</b> "The number of milligrams of potassium hydroxide required to saponify the fatty acid/materials present in of one gram of the oil.</p> <p><b>Significance:</b> It indicates the amount of animal or vegetable oil added to mineral oil to improve oiliness &amp; to find extent of adulteration.</p>	1 1
10	Principles of green Chemistry:(any three principles)	3x1=3
PART-B		
11	<p>a) Numerical problem: <math>E^0_{cell} = E_{cathode} - E_{anode} = 0.34 - (-0.7) = +1.1V;</math></p> $E_{cell} = E^0_{cell} - \frac{0.0591}{2} \log \frac{[Products]}{[Reactants]} = 1.1V - \frac{0.0591}{2} \log \frac{[0.1]}{[0.001]} = 1.0409V$	1 4



Note: Answer all questions from Part-A and answer any five questions from Part-B.

## PART – A (20 Marks)

- 1 Define Extensive and intensive properties and give suitable examples. (2)
- 2 What are the limitations of First Law of Thermodynamics? (2)
- 3 Define the terms : (i) Phase and (ii) Degrees of freedom (2)
- 4 Define the terms : (i) Triple point (ii) Eutectic point (2)
- 5 Define the terms: (i) Priming and (ii) Foaming (2)
- 6 Calculate temporary hardness and permanent hardness of a sample of water containing  $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg.L}^{-1}$ ;  $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg.L}^{-1}$ ;  $\text{MgCl}_2 = 9.5 \text{ mg.L}^{-1}$ ;  $\text{CaSO}_4 = 13.6 \text{ mg.L}^{-1}$ . (2)
- 7 Write the applications of conducting polymers. (2)
- 8 Give one example each for natural and synthetic polymers. (2)
- 9 Define the terms: (i) viscosity and (ii) viscosity index (2)
- 10 Classify refractories and give one example each. (2)

## PART – B (50 Marks)

- 11 (a) A gas expands isothermally against a constant external pressure of 1 atm. from a volume of  $10 \text{ dm}^3$  to a volume of  $20 \text{ dm}^3$ . In this process it absorbs 800 J. of thermal energy from its surroundings. Calculate  $\Delta E$  for the process in Joules. (5)
- (b) Define Gibb's and Helmholtz free energy. Derive expressions for variation of free energy with temperature and pressure. (5)
- 12 (a) State phase rule and discuss the salient features of the phase diagram of water system. (5)
- (b) Draw the phase diagram of pb-Ag system forming eutectic alloy and explain. (5)
- 13 (a) Explain the EDTA method for the determination of temporary and permanent hardness of water. (5)
- (b) Mention the specifications of potable water. (5)
- 14 (a) Write the preparation, properties and engineering applications of Bakelite. (5)
- (b) Differentiate between thermoplastic and thermosetting polymers. (5)
- 15 (a) What is meant by Lubricant? Explain the mechanism of Extreme-pressure lubrication. (5)
- (b) Explain the requirements of a good refractory material. (5)
- 16 (a) One mole of an ideal gas is heated from 100K to 300K. Calculate  $\Delta S$  if (i) the volume is kept constant (ii) the pressure is kept constant. Assume that  $C_v = 1.5 R$ . (5)
- (b) Explain the concept of breakpoint chlorination. (5)
- 17 (a) What are the limitations of raw rubber? Explain the process of vulcanization of rubber. (5)
- (b) What is meant by white wares? Give their uses. Explain the method of glazing. (5)

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14 a) What is meant by Cracking of Petroleum? Explain moving bed catalytic cracking method.

b) A sample of coal contains 60% C, 33%O, 6%H, 0.5%S, 0.2% N & remaining ash. Calculate the Gross and Net calorific value of coal.

15 a) Draw a neat labeled Phase Diagram of Water system and explain Areas, Curves & Triple point in it.

b) Write a note on Extreme Pressure Lubrication.

16 a) Differentiate between Anodic & Cathodic coatings.

b) Write a note on potentiometric titrations.

17 a) Explain Fractionation of Petroleum Crude with the help of a neat diagram

b) Define Liquid Crystals. Explain about the Thermotropic Liquid crystals.

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## FACULTY OF ENGINEERING

B.E. II – Semester (Main) Examination, June 2017

Subject: Engineering Chemistry – II

Max.Marks: 70

Time: 3 Hours

Note: Answer all questions from Part A. Answer any five questions from Part B.

## PART – A (20 Marks)

- 1 Explain why the specific conductance of an electrolyte decreases and equivalent conductance increases with dilution.
- 2 Represent quinhydrone electrode and write the electrodic reaction for reduction process and mention its S.R.P. value.
- 3 Differentiate primary and secondary battery.
- 4 Write the characteristics of fuel cells.
- 5 Corrosion of water filled steel tank occurs below the waterline. Give reason.
- 6 A copper equipment should not possess a small steel bolt. Why?
- 7 Define the terms:

i) HCV and

ii) LCV

8 Define:

i) Octane and

ii) Cetane numbers

9 Write any two applications of liquid crystals.

10 Explain the constituents of composites.

## PART – B (5x10 = 50 Marks)

- 11 a) Electrolytic conductance of a 0.01 N solution of acetic acid was found to be  $0.000163 \text{ S.cm}^{-1}$  at 298 K. Calculate the degree of dissociation of the acid.

$$\left( \begin{array}{l} \Lambda_{\infty} \\ \text{(Acetic acid)} \end{array} \right) = 390.7 \text{ S.cm}^2.\text{greq}^{-1} \text{ at } 298 \text{ K}$$

- b) Explain various types of potentiometric titrations and draw the suitable graphs.

- 12 a) Explain lead-acid battery with suitable reactions.

- b) What are lithium ion batteries? Explain their advantages and applications.



**Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.**

- 1 Represent Quinhydrone electrode and write the electrodic reaction for reduction process. 2
- 2 Explain the principle involved in conductometric titrations? How it is better than volumetric titrations. 3
- 3 Explain Galvanic corrosion. 3
- 4 What are specifications of potable water? 2
- 5 Define i) a polymer and ii) degree of polymerization. 2
- 6 Explain the mechanism of conduction in polyacetylene. 3
- 7 Classify fuels with suitable examples. 3
- 8 Write the characteristics of good propellant. 2
- 9 Define acid value of a lubricant. What is its significance? 2
- 10 Explain hydrodynamic mechanism of lubrication. 3

### PART - B (50 Marks)

- 11 a) Write the cell reaction and calculate the e.m.f of the cell at 250°C. 5  

$$\text{Zn} \left| \text{Zn}^{2+} (0.1\text{M}) \right\| \left\{ \text{Fe}^{3+} (0.2\text{M}) \right| \text{Fe}^{2+} \left| \text{Pt} \right.$$

$$(E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}) \text{ and } (E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = +0.77\text{V})$$

Is the cell reaction spontaneous.
- b) Write a note on Methanol-oxygen fuel cell. 5
- 12 a) What is a sacrificial anode? Mention its role in corrosion control? 4  
 b) Calculate temporary and permanent hardness in the following 6  
 Water sample containing  $\text{Ca}(\text{HCO}_3)_2 = 10.5 \text{ ppm}$ ;  $\text{Mg}(\text{HCO}_3)_2 = 12.5 \text{ ppm}$ ,  
 $\text{CaSO}_4 = 7.5 \text{ ppm}$ ;  $\text{CaCl}_2 = 8.2 \text{ ppm}$ ;  $\text{MgSO}_4 = 2.6 \text{ ppm}$ .
- 13 a) What do you understand by vulcanization of rubber? What are the advantages and disadvantages? 5  
 b) What are composites? Explain the properties of composites. 5

Note: Answer all questions from Part A and any five questions from Part B.

## PART – A (25 Marks)

- 1 Differentiate between electrolytic and electrochemical cell. 3
- 2 Write the chemical reaction involved in  $H_2$ - $O_2$  fuel cell 2
- 3 Explain Waterline corrosion. 2
- 4 What is Break-point chlorination? Give its significance 3
- 5 What is meant by Degree of Polymerization? 2
- 6 Mention a few applications of Composites. 2
- 7 What are the characteristics of a good propellant? 2
- 8 What is octane number? What is its significance 3
- 9 What is saponification number? What is its significance? 3
- 10 What are the principles of Green Chemistry? 3-

## PART – B (5x10 = 50 Marks)

- 11 a) Derive Nernst equation for the calculation of cell EMF and give its applications. 6
- b) What is the EMF of the following cell at  $25^\circ C$ .  
 $Zn^{(s)}/Zn^{2+}(0.2M)//Ag^+(0.002M)/Ag^{(s)}$ .  
 The standard EMF of the cell is 1.54v 4
- 12 a) What is Electrochemical Corrosion? Describe the mechanism of Electrochemical corrosion. 5
- b) Define Alkalinity of water. How is it determined? 5
- 13 a) Describe the method of preparation, properties and application of the following:  
 i) Teflon  
 ii) Perlon-U 6
- b) What is Conducting Polymer? Explain the mechanism of conduction in Polyacetylene. 4



- 13 a) Galvanization of iron articles is preferred to tinning. Give reason.  
b) What is corrosion of metals? Describe the mechanism of electrochemical corrosion by
- i) Hydrogen evolution and  
ii) Oxygen absorption
- 14 a) A sample of coal was found to have the following percentage composition.  
C = 75%, H = 5.2%, O = 12.1%, N = 3.2% and ash = 4.5%. Calculate the minimum air required for complete combustion of 1 kg of coal.
- b) Explain proximate analysis of coal and write its significance.
- 15 a) Discuss the advantages and applications of composites.  
b) Explain the principles of green chemistry.
- 16 a) Calculate the e.m.f. of the following cell at 25°C  

$$\text{Zn} | \text{ZnSO}_4 (0.1\text{M}) || \text{CdSO}_4 (0.01\text{M}) | \text{Cd}$$
 The standard reduction potential of Zn and Cd electrodes at 298 K are -0.76 V and -0.40 V respectively.  
 b) Write a note on Photovoltaic cells.
- 17 a) What is a paint? What are its constituents and explain their functions?  
b) Explain the different methods used in preparing the biodiesel and discuss its applications.

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- 14 a) What is LPG? Give the typical composition, calorific value and industrial uses of LPG. 4
- b) How do you determine the calorific value of a gaseous fuel by Junkers Calorimeter? Explain. 6

- 15 a) Classify liquid crystals and discuss their applications. 5
- b) Discuss the phase diagram of Pb-Ag system and explain its application. 5
- 16 a) Derive Nernst equation and mention its importance. 5
- b) Explain the ion-exchange method of softening the hard water. 5

- 17 a) List the differences between addition and condensation polymerization. 4
- b) A sample of coal was found to have the following percentage composition. 6
- $C = 75\%$ ;  $H = 5.2\%$ ;  $O = 12.1\%$ ;  $N = 3.2\%$  and ash = 4.5%.
- i) Calculate the minimum air required for complete combustion of 1 kg of coal.
- ii) Also calculate the HCV and LCV of coal sample.
- iii) Gross C.V. in K.cal/kg :  $C = 8,080$ ;  $H = 34,500$ ;  $S = 2,240$  (Gross C.V. in K.cal/kg :  $C = 8,080$ ;  $H = 34,500$ ;  $S = 2,240$ )

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OU - 1604

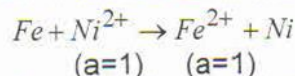


**FACULTY OF ENGINEERING****B.E. I-Year (Backlog) Examination, November / December 2018****Subject: Engineering Chemistry****Time: 3 Hours****Max. Marks: 75****Note:** Answer All Questions From Part – A, & any FIVE Questions From Part – B.**PART-A (25 Marks)**

1. Define (i) single electrode potential and (ii) Standard electrode potential 2
2. Construct the electrochemical cell to find out the end point in potentiometric titration when  $\text{Fe}^{2+}$  ion is titrated against  $\text{KMnO}_4$  Solution and draw the model graph. 3
3. Explain waterline corrosion. 3
4. Write the constituents of Paints. 2
5. Define condensation polymerization and Co-polymerization and give one example each. 3
6. Explain the mechanism of conduction in polyacetylene. 2
7. What are the requirements of a good fuel? Explain 3
8. Define the terms (i) Cracking and (ii) knocking. 2
9. Classify lubricants and give one example each. 3
10. Define the terms (i) Components and (ii) degrees of freedom. 2

**PART-B (50 Marks)**

11. a) Construct a cell for the reaction



Calculate the e.m.f. of the cell at 298K from the following standard oxidation potential data :

$$E^{\circ}_{\text{Fe}/\text{Fe}^{2+}} = 0.440\text{Volt}; E^{\circ}_{\text{Ni}/\text{Ni}^{2+}} = -0.250\text{Volt}$$

Is the cell reaction spontaneous? Give reasons. 5

- b) Construct Methanol – Oxygen fuel cell and explain its reactions and mention the applications. 5
12. a) Define metallic corrosion. Explain electrochemical theory of corrosion. 5
- b) How is boiler – feed water softened by ion-exchange method? Explain. 5
13. a) Give a descriptive account of the preparation, properties and uses of Bakelite. 5
- b) What are fiber reinforced composites? What are their advantages? Explain their applications. 5
14. a) Define octane number. What are the structural factors that promote its high value? Explain. 5
- b) A sample of coal was found to contain the following : C = 80%; H = 5%; O = 1%; N = 2% remaining being ash.
- Calculate the amount of minimum air required for complete combustion of 1 kg of coal sample. 5

Code No: 11608/A

## FACULTY OF ENGINEERING

B.E. I – Semester (Group-B) (Main) Examination, December 2018

Subject: Chemistry

Time: 3 Hours

Max. Marks: 70

Note: Answer all questions from Part A and Five questions from Part B.

### PART – A (10x2 = 20 Marks)

- 1) Represent the Calomel electrode and write its electrode reaction.
- 2) Distinguish between primary and secondary batteries.
- 3) What is break point chlorination? Explain.
- 4) Explain the principle of Cathodic protection of corrosion.
- 5) What is homo and copolymer? Give one example to each.
- 6) Write a short note on bio-degradable polymers.
- 7) What are the requirements of good fuel?
- 8) Write the advantages of gaseous fuels?
- 9) Explain atom economy in green chemistry by taking suitable example.
- 10) Differentiate between Matrix and Reinforcement in a composite.

### PART – B (50 Marks)

11. (a) Explain the determination of  $p^H$  of a solution by using Quinhydrone electrode. 5  
(b) Write the cell reaction and calculate the EMF of the cell  
 $Cu/Cu^{+2}(0.1M)//H^+(0.01M), H_2(g, 1 atm)/Pt$ . 5
12. (a) What are the disadvantages of hard water? Explain the method of removal of hardness of water by Ion-Exchange method. 6  
(b) What are different types of corrosion? Explain the mechanism of Electrochemical corrosion. 4
13. (a) What is the analysis of Coal? Explain the Proximate analysis of coal and its importance. 6  
(b) Calculate the amount of air required for complete combustion of 0.5kg of coal. 4
14. (a) Distinguish between thermoplastics and thermosetting resins. 4  
(b) Give the preparation, properties and engineering applications of the polymers:  
(i) Bakelite (ii) Nylon-6,6 6
15. (a) Explain any six important principles of Green Chemistry. 6  
(b) Write a note on Trans-esterification in Biodiesel formation. 4
16. (a) What are composite materials? Give their classification with examples. 6  
(b) Write the applications of conducting polymers. 4
17. (a) What are lithium ion batteries? Write their applications. 4  
(b) How will you determine the hardness of water by EDTA method? 6

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**FACULTY OF ENGINEERING AND INFORMATICS****BE II-Semester (Main & Backlog) Examination, May/June 2018****Subject: Engineering Chemistry-II****Time: 3 Hours****Max. Marks: 70****Note: Answer all questions from Part-A, & any FIVE Questions from Part-B.****PART-A (10x2=20 Marks)**

1. The Resistance of decinormal solution of a salt occupying a volume between two platinum electrodes 1.80 cm apart and  $5.4 \text{ cm}^2$  in area was found to be 32 ohms. Calculate the equivalent conductance of the solution.
2. Represent Quinhydrone Electrode and Write the electrodic reaction for the reduction process and mention the S.R.P of the electrode.
3. What are main advantages of alkaline battery over dry battery?
4. Explain Photovoltaic Cell.
5. What is Pilling-Bedworth Rule? Explain.
6. Explain hot dipping method of metallic coating.
7. How do you calculate the calorific value of a fuel by Dulong's Formula?
8. Write the composition of CNG and mention its uses.
9. What are the constituents of composites? Give one example of a composite material
10. Give any two examples of clean technology.

**PART-B (5x10=50 Marks)**

11. a) The equivalent conductivities of HCl, NaCl and  $\text{CH}_3\text{COONa}$  at infinite dilutions are 426.16, 126.45 and  $91.0 \text{ S-cm}^2 \text{ eq}^{-1}$  respectively. Calculate the equivalent conductivity of acetic acid at infinite dilution. If the degree of dissociation of 0.1N acetic acid is 0.001, find the equivalent conductance at this concentration of acetic acid.  
b) What are the different types of Potentiometric Titration? Explain their uses.
12. a) Describe the Working of  $\text{CH}_3\text{OH-O}_2$  fuel cell.  
b) Explain why the lead acid storage cell can be recharged.
13. a) Explain (i) Water line Corrosion and (ii) Pitting Corrosion.  
b) What is paint? Explain the constituent of paint and their functions.
14. a) Define the term cracking. Explain Catalytic Cracking by moving bed method.  
b) What are the sources of a bio-diesel? Explain the concept of transesterification.
15. a) Write the applications of Liquid Crystals.  
b) Discuss the principles of green chemistry.
16. a) Explain Kohlrausch Law and discuss any two applications of it.  
b) Discuss in detail about  $\text{H}_2\text{-O}_2$  fuel cell.
17. a) What are corrosion inhibitors? Explain Cathodic inhibitors.  
b) A sample of coal was found to have the following percentage composition:

C=75%; H=5.2%; O=12.1%; N=3.2% and ash=4.5%

Calculate the minimum air required for complete combustion of 1kg of coal.

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**FACULTY OF ENGINEERING**  
**BE I-Semester (Supplementary) Examination, May / June 2018**

**Subject: Engineering Chemistry-I**

**Max. Marks: 70**

**Time: 3 Hours**

**Note: Answer all questions from Part-A, & any FIVE Questions from Part-B.**

**PART-A (20 Marks)**

1. Explain the term State function. Give Examples. [2]
2. Give the Physical Significance of Entropy. [2]
3. What is safety Fuse? What is its purpose? [2]
4. Explain Pattinson's process of Desilverization of Lead. [2]
5. Define the terms (i) Priming (ii) Foaming. [2]
6. Write the specifications of potable water. [2]
7. Give the reaction for the preparation of Nylon 6.6 from its Monomers. [2]
8. What are conducting Polymers? Give examples. [2]
9. Write about Viscosity Index. [2]
10. Explain the property of Thermal Spalling in Refractories. [2]

**PART-B (50 Marks)**

11. (a) State First Law of Thermodynamics in its various forms. Derive the expression for maximum work done in an Isothermal reversible expansion of an ideal gas. [5]  
 (b) A Carnot cycle working between 0°C and 100°C takes up 840 Joules from the high temperature reservoir. Calculate the work done, the heat rejected and efficiency? [5]
12. (a) State Phase rule and explain the terms involved in it [5]  
 (b) Explain the Phase diagram of water system. [5]
13. (a) Write the preparation, properties and uses of (i) Bakelite (ii) Buna-S. [5]  
 (b) Distinguish between Addition and Condensation Polymerization. [5]
14. (a) What is Reverse Osmosis? How is sea water purified by using this technique? [5]  
 (b) 100ml of raw water sample on titration with  $\frac{N}{50} H_2SO_4$  required 12.4ml of acid to Phenolphthalein end point, 15.2ml of acid to methyl orange end point. Describe the type and extent of alkalinity present in the water sample. [5]
15. (a) What are Solid Lubricants? Write short note on Graphite and Molybdenum disulphide. [5]  
 (b) What is refractory material? What are the requirements of good refractory material? [5]
16. (a) Explain the terms free Energy & Work function. Discuss their significance. [5]  
 (b) Illustrate Break Point Chlorination. [5]
17. (a) Write a note extrinsic conducting Polymers. [5]  
 (b) Explain the terms (i) Refractoriness (ii) Hydrodynamic lubrication. [5]

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19.06.2018

Code No: 5

## FACULTY OF ENGINEERING

B.E. I-Year (Backlog) Examination, May / June 2018

Subject: Engineering Chemistry

Max. Marks: 75

Time: 3 Hours

Note: Answer All Questions From Part – A, & any FIVE Questions From Part – B.

### PART-A (25 Marks)

1. Define standard electrode potential. Find the EMF of the following cell:  
 $Zn / Zn^{2+} (1M) // Cu^{2+} (1M) / Cu$  given  $E^0(Zn^{2+} / Zn) = -0.76V$  &  $E^0(Cu^{2+} / Cu) = 0.34V$ . 3
2. Differentiate between primary and secondary batteries 3
3. What is reverse osmosis? 3
4. What is paint? What are the main constituents of paint? 2
5. Differentiate between homopolymer and co – polymer. 2
6. Define a composite material 2
7. Write the applications of conducting polymers. 3
8. Distinguish between Gross and Net calorific Value of a fuel. 2
9. What is trans – esterification? 2
10. State Phase Rule.

### PART-B (50 Marks)

11. a) What are reference electrodes? Describe the construction of Calomel electrode. 6  
 b) Describe the Ni-Cd battery with charging and discharging reactions. 4
12. a) What is corrosion? Explain the factors effecting the rate of corrosion. 5  
 b) 50ml of a sample water consumed 15 ml of 0.01M EDTA before boiling and 5 ml. of the same EDTA after boiling. Calculate the total, permanent and temporary hardness. 4
13. a) Distinguish between thermoplastic and thermo- setting polymers. 6  
 b) Describe the method of preparation, properties and applications of the following:  
 (i) Bakelite (ii) Buna - S
14. a) Explain the determination of calorific value of gaseous fuel by Junker's calorimeter 6  
 b) Explain the proximate analysis of coal What is its significance? 4
15. a) What is lubrication? Explain the mechanism of hydrodynamic lubrication 5  
 b) Explain Pb-Ag system on the basis of phase-rule. 6
16. a) Write a note on conducto metric titrations. 4  
 b) Explain the principles of green chemistry
17. a) Differentiate between low temperature and high temperature carbonization of coal. 3  
 b) Write a note on  
 (i) Liquid crystals (ii) Lithium ion cells (iii) Acid Value 7

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**FACULTY OF ENGINEERING****B.E. II-Semester (CBCS) (Suppl.) Examination, November /December 2018****Subject : Engineering Chemistry-II****Time: 3 Hours****Max. Marks: 70**

Note: Answer all questions from Part -A and any five questions from Part-B.

**PART-A (10x2 =20 Marks)**

- 1 Define the terms (i) equivalent conductance and (ii) Molar conductance.
- 2 Represent glass electrode and mention its use.
- 3 Explain the concept of fuel cells
- 4 Differentiate primary and secondary batteries
- 5 What is pilling-Bed worth rule? Explain
- 6 Explain tinning method
- 7 What are the characteristics of a good fuel?
- 8 Why are gaseous fuel more advantageous than solid fuels?
- 9 What is layered composite? Provide one example of layered composite
- 10 Explain importance of "atom economy" with a suitable example.

**PART-B (5x10=50 Marks)**

11. a) At 298K, The solution of 0.1M KCl and 0.1M AgNO<sub>3</sub> gave the resistance of 337.6 and 397.9 ohms respectively. Calculate (i) the cell constant (ii) equivalent conductance of 0.1M Ag NO<sub>3</sub>, given conductivity of 0.1M KCl =  $1.286 \times 10^{-3} \text{ S-cm}^{-1}$   
b) Define the term Single electrode potential. How do you determine the electrode potential of Zn/Zn<sup>2+</sup> using potentiometer? Explain.
- 12 a) Explain H<sub>2</sub>-O<sub>2</sub> fuel cell with diagram and cell reaction  
b) What are Lithium ion batteries? Explain its advantages and applications.
- 13 a) What is meant by electrochemical corrosion? Explain its mechanism.  
b) Write a note on cathodic protection by impressed current method.
- 14 a) Calculate the volume of air required for complete combustion of 1m<sup>3</sup> of gaseous fuel having the composition : CO=46%, CH<sub>4</sub>=10%, H<sub>2</sub> = 4%, C<sub>2</sub>H<sub>2</sub>= 2.0%, N<sub>2</sub> = 1.0% and remaining being CO<sub>2</sub>.  
b) Explain the terms (i) Knocking (ii) Octane number (iii) Cetane number
- 15 a) Differentiate between fibre and particle-reinforced composites.  
b) Explain the molecular ordering in liquid crystals and mention their applications.
- 16 a) Derive Nerst equation and explain its use.  
b) Write a note on photovoltaic cells.
- 17 a) What are the various factors effecting rate of corrosion? Explain.  
b) Explain ultimate analysis of coal and mention its significance.

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## FACULTY OF ENGINEERING

B.E I-Semester (CBCS) (Backlog) Examination, November / December 2018

Sub: Engineering Chemistry-I

TIME: 3 Hours

Max. Marks: 70

Note: Answer All Questions from Part – A and Any Five Questions From Part-B.

## PART-A (20 Marks)

1. Write the limitations of first law of thermodynamics 2
2. Calculate the efficiency of heat engine when operates between 27°C and 127°C 2
3. Define phase and component in a phase rule with example. 2
4. What is a triple point? Explain. 2
5. Calculate the carbonate and non carbonate hardness of a sample of water in ppm containing:  $\text{Mg} [\text{H CO}_3]_2 = 73\text{mg.L}^{-1}$ ,  $\text{Ca} [\text{H CO}_3]_2 = 16.2 \text{ mg.L}^{-1}$   $\text{Mg Cl}_2 = 19 \text{ mg.L}^{-1}$ ,  $\text{CaSO}_4 = 27.2 \text{ mg.L}^{-1}$  and  $\text{NaCl} = 30 \text{ mg.L}^{-1}$  2
6. What is reverse osmosis? What are its advantages 2
7. Differentiate between homo and copolymers with examples. 2
8. Generally polymers are insulators but why polyaniline is not an insulator? Explain 2
9. Classify the refractories and mention one example for each. 2
10. What are the functions of a Lubricant? 2

## PART-B (50 Marks)

11. a) State and explain carnot theorem for the maximum convertibility of heat into work 6
- b) Calculate the maximum work done when 5 moles of an ideal gas expands isothermally and reversibly from 20 liters to 100 liters at 27°C. 4
12. a) Draw a well labelled phase diagram of silver and lead system and explain desilverization of lead. 6
- b) Write a short notes on (i) solders (ii) fuses. 4
13. a) What is meant by sterilization of water? Explain break – point chlorination 5
- b) What are scales and sludges? Discuss their disadvantages. 5
14. a) Give preparation, properties and uses of (i) PVC (ii) Kevlar 5
- b) Discuss the chemistry of vulcanization of rubber and compare the properties of Vulcanized rubber and raw rubber. 5
15. a) Explain the mechanism of extreme-pressure lubrication. 5
- b) Explain the terms (i) refractoriness under load RUL (ii) Thermal spalling 5
16. a) Discuss the entropy changes in a reversible and irreversible process. 5
- b) Describe the softening of hard water by ion – exchange method. 5
17. a) Differentiate between thermoplastic and thermosetting polymers. 5
- b) Explain the terms (i) glazing (ii) Viscosity index. 5

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**FACULTY OF ENGINEERING & INFORMATICS****B.E. I-Semester (Suppl.) Examination, June / July 2017****Subject : Engineering Chemistry-I****Time : 3 hours****Max. Marks : 70****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (20 Marks)**

- |                                                                                                                                                                                                                                                                                                |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1 State and explain First law of thermodynamics.                                                                                                                                                                                                                                               | 2 |
| 2 State Carnot theorem.                                                                                                                                                                                                                                                                        | 2 |
| 3 What is meant by the term eutectic?                                                                                                                                                                                                                                                          | 2 |
| 4 State phase rule.                                                                                                                                                                                                                                                                            | 2 |
| 5 Calculate the carbonate and non-carbonate hardness of a sample of water in ppm containing : $\text{Ca}(\text{HCO}_3)_2 = 8.1 \text{ mg.L}^{-1}$ ; $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg.L}^{-1}$ ; $\text{MgCl}_2 = 9.5 \text{ mg.L}^{-1}$ ; $\text{CaSO}_4 = 13.6 \text{ mg.L}^{-1}$ . | 2 |
| 6 Define the terms i) Scale and ii) sludge                                                                                                                                                                                                                                                     | 2 |
| 7 Give one example each for Addition and Condensation polymers.                                                                                                                                                                                                                                | 2 |
| 8 Write the structures of poly-acetylene and poly-aniline.                                                                                                                                                                                                                                     | 2 |
| 9 Define the terms i) Saponification number and ii) acid value                                                                                                                                                                                                                                 | 2 |
| 10 Explain the property of RUL in refractories.                                                                                                                                                                                                                                                | 2 |

**PART – B (50 Marks)**

- |                                                                                                                                                                    |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 11 a) Calculate the maximum work done when 2 moles of an ideal gas expand isothermally and reversibly from a volume of 10 litres to a volume of 20 litres at 298K. | 5 |
| b) Explain the criteria for spontaneity of a process in terms of entropy and free energy.                                                                          | 5 |
| 12 a) What do you understand by the reduced phase rule equation? Discuss the use of the phase rule in Pattinson's process of desilverization of lead.              | 5 |
| b) Define the terms i) Phase ii) component iii) degrees of freedom.                                                                                                | 5 |
| 13 a) Explain the procedure for the determination of Alkalinity of water.                                                                                          | 5 |
| b) Discuss the concept of break point chlorination.                                                                                                                | 5 |
| 14 a) Explain the preparation, properties and applications of Nylon-6,6.                                                                                           | 5 |
| b) Differentiate between thermoplastic and thermosetting polymers.                                                                                                 | 5 |
| 15 a) Classify lubricants and give one example each for various type of lubricants.                                                                                | 5 |
| b) Write a note on the following properties of Refractories.<br>i) Refractoriness ii) Thermal spalling                                                             | 5 |
| 16 a) Derive an expression for the efficiency of heat engine by using Carnot cycle.                                                                                | 6 |
| b) Discuss the ion-exchange method of softening hard water.                                                                                                        | 4 |
| 17 a) Write a note on intrinsic conducting polymers                                                                                                                | 5 |
| b) Explain the terms i) viscosity index ii) glazing                                                                                                                | 5 |