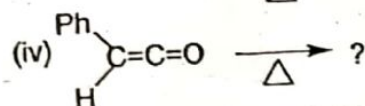
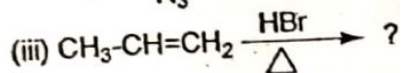
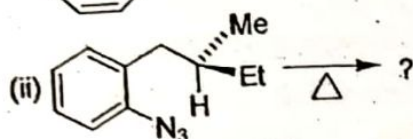
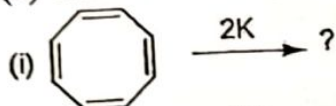


The figures in the margin indicate full marks for the questions  
Candidates are required to give their answers in their own words as far as practicable  
Answer ALL questions: each question carries 20 marks

1. (a) Write down the product/s of the following reactions:



(b) What are carbenes? Give two methods for the preparation of carbene. Also comment on their structure and stability.

[(2+3+2+3)+(2+(2+2)+(2+2))=20]

2. (a) Derive and explain van der Waal's equation for real gases.

(b) Define critical temperature? For  $\text{CO}_2$  write down the values of critical constants.

(c) What do you mean by steady state? Give an account of Maxwell's distribution of velocities. Explain graphically how the velocities change with temperature.

[(4+3)+(1+2)+(2+(5+3))=20]

3. (a) What is spin correlation? Find out the exchange energy for four  $p$ -electrons when-  
i) Hund's rule is obeyed and ii) maximum pairing energy.

(b) Write notes on- i) van der Waal's radius ii) covalent radius iii) ionic radius and iv) atomic radius.

(c) Derive the ground state term symbol for (i)  $\text{Ni}^{2+}$  (ii) Fe (iii)  $\text{Cl}^-$

(d) What would be the size of a  $\text{Ne}^{9+}$  ion according to the Bohr model?

[4+8+6+2=20]

4. (a) What are quantum numbers? Which quantum number is used to express the orbital angular momentum of an electron? How does we represent space quantization of the orbital angular momentum vector of an electron?

(b) Why mercury is liquid?

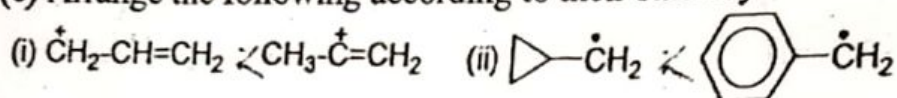
(c) Calculate  $Z_{\text{eff}}$  experienced by (i) 5s electron (ii) 4d electron (ii) in Ag atom.

(d) What is Moseley characteristic X-ray? How does Moseley resolved the characteristic X-ray produced by an element.

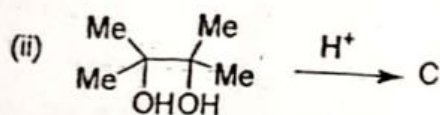
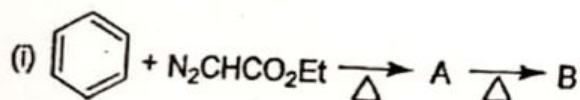
(e) Discuss the variation in melting point and boiling point along the period and down the group in p-block element.

[5+2+5+4+4=20]

5. (a) Electron affinity of Cl is greater than that of F but reverse is true for their electronegativity. Justify
- (b) Why does beryllium and aluminium resemble in their properties?
- (c) What will be the wavelength of the second line in the visible spectrum of atomic hydrogen?
- (d) What is Pauling's scale of electronegativity? State the factors which affect the electronegativity values?
- (e) Arrange the following according to their stability:



- (f) With proper reaction mechanism explain the formation of the following products:



$$[3+2+2+3+(1 \times 4)+(2+4)=20]$$

\*\*\*\*\*



Answer ALL the questions below

*The figures in the margin indicate full marks for the questions*

The following questions have four choices, out of which only one is correct. Choose the correct option.

- (i) ----- gas responsible for acid rain.  
(a) NO<sub>2</sub> (b) H<sub>2</sub>S (c) CO<sub>2</sub> (d) O<sub>2</sub>
- (ii) Which of the following is an example of primary pollutant?  
(a) HNO<sub>3</sub> (b) SO<sub>3</sub> (c) H<sub>2</sub>SO<sub>4</sub> (d) CO
- (iii) ----- used as absorbing agent for spectrophotometric determination of NOx  
(a) Sulfanilic acid (b) CaCl<sub>2</sub> (c) NaOH (d) Na<sub>2</sub>HgCl<sub>4</sub>
- (iv) ----- is an example of strong electrolyte  
(a) CH<sub>3</sub>COOH (b) HCOOH (c) HNO<sub>3</sub> (d) NH<sub>4</sub>OH
- (v) The unit of cell constant is  
(a) cm<sup>2</sup> (b) cm (c) cm<sup>-1</sup> (d) cm<sup>-2</sup>
- (vi) pH of 0.001M NH<sub>4</sub>OH is  
(a) 3 (b) 10 (c) 11 (d) 12
- (vii) If a conductance cell has two parallel plate of 1.25 cm<sup>2</sup> area placed in 10.50 cm apart and filled with a solution of an electrolyte the resistance was found to be 2.0x10<sup>-3</sup> ohms. The specific conductance of the solution will be  
(a) 8.4 cm<sup>-1</sup> (b) 4.2 x 10<sup>-3</sup> ohm<sup>-1</sup>cm<sup>-1</sup> (c) 8.4 ohm<sup>-1</sup>cm<sup>-1</sup> (d) 4.2 cm<sup>-1</sup>
- (viii) Hardness of water is conventionally expressed in terms of equivalent amount of  
(a) H<sub>2</sub>CO<sub>3</sub> (b) MgCO<sub>3</sub> (c) Na<sub>2</sub>CO<sub>3</sub> (d) CaCO<sub>3</sub>
- (ix) Caustic embrittlement can be avoided by using  
(a) Na<sub>3</sub>PO<sub>4</sub> (b) NaOH (c) NH<sub>4</sub>OH (d) H<sub>2</sub>SO<sub>4</sub>
- (x) Permanent hardness of water cannot remove by  
(a) lime soda process (b) permutit process (c) boiling (d) ion-exchange process
- (xi) Co-polymerisation of Isobutene and isoprene results in the formation of  
(a) Bakelite (b) BUNA-S rubber (c) BUNA-N rubber (d) Butyl rubber (GR-I)
- (xii) In Buna-N rubber the symbol N represents  
(a) nitrogen (b) neoprene (c) sodium (d) none of these
- (xiii) Which of the following can be used as initiator in free-radical polymerization?  
(a) Grignard reagent (b) Lewis acids (c) Lewis base (d) Benzoyl peroxide
- (xiv) Which of the following compound absorbs CO<sub>2</sub>?  
(a) CaCl<sub>2</sub> (b) KOH (c) K<sub>2</sub>CO<sub>3</sub> (d) NaCl
- (xv) Isooctane has an octane rating of  
(a) 100 (b) 0 (c) 0.50 (d) none of these
- (xvi) If gross calorific value of a coal sample is 8828.0 kcal/kg, the net calorific value will be  
(a) 9000 kcal/kg (b) 9227.8 kcal/kg (c) 8458.2 kcal/kg (d) 8828.0 kcal/kg
- (xvii) Number of bond pairs present in NH<sub>3</sub> molecule is  
(a) 1 (b) 2 (c) 3 (d) 4
- (xviii) The s-orbital does not show preference to any direction because  
(a) it is the smallest orbital (b) it is present in every atom  
(c) it is dumbbell shape (d) it is spherically symmetrical
- (xix) Which of the following overlap has highest bond energy?



- (i) 1s-1s (b) 2s-2s (c) 2s-2p (d) 2p-2p (side wise)  
 (xx) Which of the following molecule/ion has highest bond order?  
 a)  $\text{He}_2^{2+}$  (b)  $\text{H}_2^+$  (c)  $\text{O}_2^-$  (d)  $\text{O}_2^{2+}$

2. (a) Match the entries of column I with entries of column II.

Column I	Column II
(a) $\text{CH}_4$	(i) Spectrophotometric determination of $\text{H}_2\text{S}$
(b) $\text{HNO}_3$	(ii) Spectrophotometric determination of $\text{SO}_x$
(c) Peroxy benzyl nitrate	(iii) Greenhouse effect
(d) <i>p</i> -rosaniline	(iv) Photochemical smog
(e) $\text{CdSO}_4 + \text{NaOH}$	(v) Acid rain

(b) Match the entries of column I with entries of column II.

Column I	Column II Boiling point range
(a) Uncondensed gases	(i) 120. - 180 °C
(b) Naphtha	(ii) 250- 320 °C
(c) Kerosene oil.	(iii) 40 - 120 °C
(d) Gasoline	(iv) Below 30°C
(e) Diesel oil	(v) 180 - 250 °C

(c) Determine the molar conductivity of  $\text{NH}_4\text{OH}$  by applying Kohlrausch law.

(d) A conductor cell has two parallel plates of  $1.00 \text{ cm}^2$  area placed at  $10.00 \text{ cm}$  apart, when filled with a solution of an electrolyte, the resistance was found to be  $1.0 \times 10^3 \text{ ohms}$ . Calculate the cell constant and the specific conductance of the solution.

(e) Discuss the variation of equivalent conductance with dilution with proper examples.

3. (a) Define calorific value and classify it.

[5+5+3+3+4=20]

(b) Determine the content of nitrogen in coal sample by ultimate analysis.

(c) A sample of coal was analyzed as follows: Exactly  $2.5 \text{ g}$  was weighed into a silica crucible. After heating for one hour at  $110^\circ \text{C}$ , the residue weighed  $2.415 \text{ g}$ . The crucible next was covered with a lid and strongly heated for exactly 7 minutes at  $950 \pm 20^\circ \text{C}$ . The weight of the residue was found to be  $1.528 \text{ g}$ . The crucible was then heated without the cover, until a constant weight was obtained. Calculate the percentage results of the above analysis.

(d) Write five differences between thermoplastic and thermosetting polymers.

(e) Write the anionic mechanism (with example) of addition polymerization.

4. (a) What are ion-exchange resins? Discuss their application in water softening. How are used resins regenerated?

[3+4+5+3+5=20]

(b) How is boiler corroded by dissolved oxygen? How dissolved oxygen can be removed from boiler water?

(c) Calculate the amount of lime required for softening 50000 litres of hard water containing:  $\text{CaCO}_3 = 25 \text{ ppm}$ ,  $\text{MgCO}_3 = 144 \text{ ppm}$ ,  $\text{CaCl}_2 = 111 \text{ ppm}$ ,  $\text{MgCl}_2 = 95 \text{ ppm}$ ,  $\text{Na}_2\text{SO}_4 = 15 \text{ ppm}$  and  $\text{Fe}_2\text{O}_3 = 25 \text{ ppm}$ .

(d) Define BOD. How is it determined?

5. (a) In the light of valence bond theory draw the orbital model of  $\text{NH}_3$  molecule giving proper reason.

[(2+3+2)+(2+1)+5+(1+4)=20]

(b) Using molecular orbital theory, explain why  $\text{He}_2$  molecule does not exist.

(c) Determine the shape of the following species using the concept of VSEPR theory.

i)  $\text{ClF}_3$  ii)  $\text{XeF}_2$  iii)  $\text{I}_3^-$

(d) What is photochemical smog? Write down the chemical reactions involved in the formation of photochemical smog. Discuss the harmful effects of photochemical smog.

(e) Discuss one method for the determination of  $\text{NO}_x$ .

[2+2+(3x2)+(1+2+3)+4 = 20]



B.Tech 1<sup>st</sup> Semester End-Term Examination, 2017

Engineering Chemistry -I

Code: UCE/ME/EE/CS/EC/CH/PE/BE-01C01

Time: 3 Hrs

Full Marks: 100

Answer ALL the questions below

The figures in the margin indicate full marks for the questions

Match the entries of column I with entries of column II.

Column I (Molecule)

- (a) SF<sub>6</sub>
- (b) BF<sub>3</sub>
- (c) ClF<sub>3</sub>
- (d) C<sub>2</sub>H<sub>2</sub>
- (e) SF<sub>4</sub>
- (f) I<sub>3</sub><sup>-</sup>

Column II (Hybridization and shape)

- (i) sp<sup>3</sup>d and T-shaped
- (ii) sp<sup>3</sup>d and Linear
- (iii) sp<sup>3</sup>d<sup>2</sup> and Octahedral
- (iv) sp<sup>3</sup>d and See-saw
- (v) sp and Linear
- (vi) sp<sup>2</sup> and Trigonal planner

Using molecular orbital energy level diagram, compare the bond length and magnetic behavior of N<sub>2</sub> and N<sub>2</sub><sup>-</sup> species.

Why *p*-nitrophenol has higher boiling point than *o*-nitrophenol ?

Explain the formation of bond by different types of overlapping of p-atomic orbitals with suitable examples.

A coal sample has the following composition by weight: C = 80%, O = 4%, S = 0.5% N = 3% and Ash 4%. Net calorific value (NCV) of coal was found to be 9000 Kcal/Kg. Calculate the percentage of hydrogen and higher calorific value (HCV) of coal.

[6+4+2+3+5 = 20]

2. Define Octane number and Cetane number with a suitable example.

Write the method of preparation of following polymers with proper chemical reaction.

- (i) Butyl rubber (ii) Nitrile rubber (Buna-N) (iii) Polystyrene (iv) Polyethylene

Explain the anionic mechanism of polymerization of CH<sub>2</sub>=CHX, Where X is the electron withdrawing group.

Match the column I with column II.

Column I

- (M) Neoprene (ii)
- (N) Ziegler Natta catalyst (iii)
- (O) Nylon 6:6 (iv)
- (P) Cellulose (v)

Column II

- (i) polymer of β-D-glucose
- (ii) Chloroprene
- (iii) Stereospecific polymerization
- (iv) Adipic acid and hexamethyl diamine

[(2+2)+(2x4)+4+4 = 20]  
Continued



3. (a) Define the terms: (i) specific conductance (ii) equivalent conductance. With the aid of a plot, explain the variation of equivalent conductance of KCl and  $\text{CH}_3\text{COOH}$  on dilution.
- (b) State and explain Kohlrausch's law of independent migration of ions. Discuss its application in determination of equivalent conductance of weak electrolytes at infinite dilution.
- (c) How will you determine pH of a buffer solution containing a weak base and its high ionized salt?
- 30 ml of 0.1 M NaOH is added to 100 ml of 0.1 M solution of acetic acid. Calculate pH of the buffer solution. ( $K_a$  of  $\text{CH}_3\text{COOH} = 1.8 \times 10^{-5}$ ).

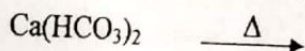
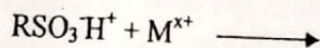
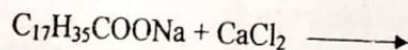
$$[(3+2)+(2+3)+5+5 = 20]$$

4. (a) What is photo-chemical smog? Write the reactions involved in photo-chemical smog formation.
- (b) What is ozone layer depletion? Write the reactions involved in ozone layer depletion? How does the depletion of the ozone layer affect human health?
- (c) Write the spectro-photometric analysis of  $\text{SO}_x$ .
- (d) Define chemical oxygen demand (COD). How would you determine COD of a water sample?

$$[(1+4)+(1+3+1)+5+(2+3)=20]$$

5. (a) Calculate the quantity of lime and soda required for softening of 50,000L of water containing the following salt per litre:  $\text{Ca}(\text{HCO}_3)_2 = 8.1$  mg,  $\text{Mg}(\text{HCO}_3)_2 = 7.5$  mg,  $\text{CaSO}_4 = 13.6$  mg,  $\text{MgSO}_4 = 12.0$  mg,  $\text{MgCl}_2 = 2.0$  mg,  $\text{NaCl} = 5.0$  mg.

- (b) Write the products for the following chemical reactions:



- (c) What are zeolites? Explain in brief Zeolite process for softening of hard water. Suggest a method to regenerate zeolites. (Give chemical reactions involved during the process).
- (d) What is boiler corrosion? Write the chemical reactions involved during boiler corrosion caused due to the presence of dissolved  $\text{O}_2$  and  $\text{CO}_2$ . Write the method for removal of dissolved  $\text{O}_2$  and  $\text{CO}_2$  with their chemical reactions.

$$[5+3+(2+3+2)+(1+2+2) = 20]$$

B.Tech 1<sup>st</sup> Semester End Term Examination, 2016

## Engineering Chemistry-I

Code : UCE/ME/EE/CS/EC/EI/CH/PE/BE01C02

Full Marks: 100

Time: 3 Hrs

*The figures in the margin indicate full marks for the questions**Candidates are required to give their answers in their own words as far as practicable**Answer ALL QUESTIONS: Each question carries 20 marks.*

✓ (a) Match the following

- |                       |                        |
|-----------------------|------------------------|
| i) VSEPR              | i) boiling point       |
| ii) s-p orbitals      | ii) Shape              |
| iii) Hydrogen bonding | iii) Hybridisation     |
| iv) Ozone depletion   | iv) CaSiO <sub>3</sub> |
| v) Scale              | v) sigma-bond          |
| vi) VBT               | vi) NO                 |

✓ (b) Write down the reaction for the preparation of the following polymers:

(i) Butyl rubber (ii) Buna-N (iii) PAN (iv) Neoprene

✓ (c) State the postulates of Valence Bond Theory.

✓ (d) Arrange the molecules (below) in the increasing order of their bond angle with proper justification- CH<sub>4</sub>, H<sub>2</sub>O, NH<sub>3</sub>

2 ✓ (a) Discuss the free radical mechanism of polymer.

[(1x6)+(2x4)+3+3=20]

✓ (b) What are cation and anion exchange resins? Write down the water softening process by ion-exchange method. Also mention the regeneration process.

✓ (c) Calculate the amount of lime required for treatment of 50,000 liters of hard water, containing:

MgCO<sub>3</sub> = 144 ppm, CaCl<sub>2</sub> = 111 ppm, MgCl<sub>2</sub> = 95 ppm, Na<sub>2</sub>SO<sub>4</sub> = 15 ppm, Fe<sub>2</sub>O<sub>3</sub> = 25 ppm

✓ (d) What is caustic embrittlement? Explain the phenomenon with chemical reactions involved in it. How it may be removed?

3. (a) What is meant by photochemical smog? Write down the reaction for the formation of PAN and discuss harmful effects of photochemical smog on human health and plants.

[5+(2+4+2)+4+(1+1+1)=20]

✓ (b) What do you mean by ozone depletion? How does ozone depletion occur by CFC?

✓ (c) Discuss the spectrophotometric method for the analysis of atmospheric NO<sub>2</sub> with reaction.

✓ (d) Define the term BOD? How is BOD of a sample of water determined?

[(1+2+2)+(1+4)+5+(1+4)=20]



4. ✓(a) Draw molecular orbital energy diagram of  $\text{He}_2$  and write the electronic configuration of  $\text{He}_2$  and  $\text{He}_2^+$ . Calculate their bond order?
- ✓(b) Mention four Postulates of VSEPR Theory.
- ✓(c) A coal sample has the following composition by weight: C = 90%, O = 3%, S = 0.5%, N = 0.5%, and ash = 2.5%. Net calorific value of the coal is found to be 8,490.5 kcal/kg. Calculate the percentage of hydrogen and HCV of coal.
- ✓(d) Write the reaction with proper explanation for the ultimate analysis of carbon and hydrogen in the coal.
- ✓(e) Define gross calorific value and net calorific value? [(2+2+2)+4+4+4+2=20]

5. ✓(a) Write the equation and explain Kohlrausch's law of independent migration of ions.
- ✓(b) How will you determine the molar conductivity of a weak electrolyte using Kohlrausch's law?
- ✓(c) Explain the mechanism of action of acetic buffer and basic buffer.
- ✓(d) Define the term hybridization. Mention the different hybrid orbitals that will be formed on mixing  $s$  and  $p$  atomic orbitals. State the possible geometry for the hybrid orbitals. Give one example of a molecule of each type of hybrid orbital.
- ✓(e) Arrange the following orbitals in the increasing order of their energy.

ABMO, BMO, AO

(AO: Atomic Orbital, BMO: Bonding Molecular Orbital, ABMO: Antibonding Molecular Orbital)

- ✓(f) Define solubility product with an example.

[2+4+4+(1+2+2+2)+1+2=20]

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## BTech/Semester-I/End-Term Examination/2015

## Engineering Chemistry -I

Code: UCE/ME/EE/CS/EC/EI/CH/PE/BE01C02

Full Marks: 100

Time: 3 hours

*The figures in the margin indicate full marks for the questions*

Answer ALL questions: each question carries 10 marks

1. a) Briefly define the following with examples

✓i) Vulcanization of rubber ✓ii) COD ✓iii) Caustic embrittlement

b) Match Column A with Column B

- A
- ✓i) VBT
  - ii)  $\text{CaSiO}_3$
  - iii) KI
  - ✓iv) Dioxygen
  - v) VSEPR
  - ✓vi)  $\text{I}_3^-$
  - ✓vii) Nylon 6:6
  - ✓viii) Neoprene

- B
- ✓i) Adipic acid
  - ✓ii) Geometry of the molecule
  - iii) Tetrahedral
  - ✓iv) Elastomer
  - ✓v) Linear
  - ✓vi) Hybridization
  - ✓vii) Scale
  - ✓viii) Para magnetic
  - ix) Free Chlorine Estimation

[(2+2+2)+4=10]

2. a) Arrange the following molecules in the order of increasing bond angles and justify.

 $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$ ,  $\text{H}_2\text{Se}$ b) Draw the molecular orbital diagram of  $\text{O}_2$  and  $\text{N}_2$ . Predict their bond order & magnetic behavior. Which one is inert and why?

[2+(5+2+1)=10]

3. a) Explain the difference between octane number and cetane number with examples.

b) Describe with equation how do you find % of nitrogen in a coal sample by ultimate analysis method.

c) Calculate the gross and net calorific value of coal having the following compositions  
carbon = 85 %, hydrogen = 8%, sulphur = 1%, nitrogen = 2%, ash = 4%, latent heat of steam = 587 cal/g.

[4+4+2=10]

4. a) Discuss the free radical polymerization mechanism for the formation of addition polymers.

b) Write the method of synthesis, one property and an application of Neoprene.

c) What is thermosetting polymer? Give example.

[4+4+2=10]

5. a) What is boiler corrosion? Write down chemical reactions of boiler corrosion by dissolved oxygen and also mention two chemical processes of removal of dissolved



oxygen.

- b) Calculate the temporary and permanent hardness of a sample of water containing  $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg/L}$ ;  $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg/L}$ ;  $\text{MgCl}_2 = 9.5 \text{ mg/L}$ ;  $\text{CaSO}_4 = 13.6 \text{ mg/L}$ . (Atomic weights of Mg and Ca are 24 and 40 respectively) [(1+3+3)+3=10]
6. a) What are scale and sludge? Discuss their formation and disadvantages? [(2+4)+4=10]
- b) Discuss the lime-soda process for softening of hard water with suitable reactions.
7. a) What is photochemical smog? Describe the formation and harmful effects of photochemical smog. [(1+2+3)+(1+3)=10]
- b) What is meant by ozone depletion? How does ozone depletion occur by  $\text{NO}_x$ ? [5+(1+4)=10]
8. a) How can atmospheric  $\text{SO}_2$  be analysed spectrophotometrically? [5+(1+4)=10]
- b) Define BOD. How BOD of a sample of water is determined? [5+(1+4)=10]
9. a) Define degree of dissociation of an electrolyte? On which factors it depends? [5+(1+4)=10]
- b) State and derive Ostwald dilution law.
- c) Calculate the amount of  $\text{NH}_3$  and  $\text{NH}_4\text{Cl}$  required to prepare a buffer of pH 9.0, when the total concentration of buffering reagent is  $0.6 \text{ mol L}^{-1}$ .  $pK_b = 4.7$   
[(2+1)+(1+3)+3=10]
10. a) What is buffer solution? Mention the types of buffer solution with example? [(2+1)+(1+3)+3=10]
- b) Specific conductivity of N/50 KCl solution at  $25^\circ\text{C}$  is  $0.0002765 \Omega^{-1} \text{ cm}^{-1}$ . If the resistance of the cell containing this solution is  $500 \Omega$ . What is the cell constant?
- c) Derive the Henderson equation for pH of an acidic buffer. [(2+2)+2+4=10]

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B.Tech 1<sup>st</sup> Semester End Term Examination, 2014

Engineering Chemistry -1

Code: UCE/ME/EE/CS/EC/EI/CH/PE/BE01C02

Time : 3 hours

Marks: 50

The figures in the margin indicate full marks for the questions

Answer any 5 (five) questions from the following

1. (a) Differentiate between 'Biological Oxygen Demand' and 'Chemical Oxygen Demand'.  
How BOD is determined in a water sample? (1.5+1.5+3)
- (b) Describe the spectrophotometric method for the determination of NO<sub>2</sub> in a given air sample. (4)
2. (a) Describe the (ion exchange method for softening hard water) (4)
- (b) What do you mean by 'Boiler Corrosion'? Explain the causes of boiler corrosion. (1+2)
- (c) Explain the term 'Caustic Embrittlement'? How it can be avoided? (2+1)
3. (a) What is Cetane number? What is its importance? (1+1=2)
- (b) What is Cracking? Discuss the catalytic Cracking process. Mention two important advantages over thermal cracking process. (1+3+1=5)
- (c) Describe how moisture, volatile material, ash content and carbon content of a coal sample is determined? (1.5x2=3)
4. (a) Write down the mechanism of Cationic polymerization. (3)
- (b) Write down the name and structure of the monomer(s) of the following polymers:  
Polystyrene, PTFE, SBR (3)
- (c) Define glass transition temperature. (1)
- (d) Write down the preparation of Polystyrene, Poly ethylene and Nylon 66 (3)
5. (a) Draw the MO diagram of O<sub>2</sub><sup>+</sup> ion. Calculate its bond order and predict the magnetic behaviour. (2+1+1)
- (b) Predict hybridisation state and shape of the following molecules with the help of VSEPR theory. (2x3=6)  
IF<sub>7</sub>, XeF<sub>4</sub>, PCl<sub>3</sub>



6. (a) Calculate pH of  $10^{-9}$  M  $\text{H}_2\text{SO}_4$  Solution

(b) The molar conductivity of  $\text{NH}_4\text{OH}$  at concentration of 0.1 M and 0.001 are 3.6 and 34  $\text{Scm}^2 \text{Mol}^{-1}$  respectively. Calculate degree of dissociation of  $\text{NH}_4\text{OH}$  at these concentration. Molar conductance at infinite dilution for  $\text{NH}_4\text{OH}$  is  $271.1 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ .

(c) Define the following terms:-

(i) Buffer solution (ii) Buffer capacity (iii) Molar conductance

(d) How the conductance of Acetic acid at infinite dilution is determined using Kohlrausch law.