B.Tech 1st Semester Mid-Term Examination, 2018
Engineering Chemistry -1
Code: UCE/ME/EE/CS/EC/EI/CH/PE/BE01C01

Full Marks: 50   Time: 2 Hrs.

Answer ALL the questions below

The figures in the margin indicate full marks for the questions

1. (a) The following question has four choices, out of which only one is correct. Choose the correct option.

(i) Combustion reaction of fuel is
  (a) Endothermic reaction   (b) Exothermic reaction   (c) Auto catalytic reaction
  (d) double displacement reaction

(ii) Which of the following compound is absorb by $CaCl_2$
  (a) CO   (b) CO_2 (c) H_2O (d) H_2

(iii) The calorific value of a fuel is expressed as
  (a) kcal/m   (b) kcal/kg   (c) Cal/cm^3 (d) kcal /g

(iv) An example for secondary fuel is
  (a) petroleum   (b) natural gas   (c) coke   (d) coal

(v) The calorific value of fuel depends upon the percentage of
  (a) volatile matter   (b) ash   (c) fixed carbon   (d) moisture

(vi Which of the following molecule exhibit intramolecular hydrogen bonding
  (a) m-nitrophenol   (b) o-nitrophenol   (c) p-nitrophenol   (d) H_2O

(vii) Number of bonding pairs of electrons in water molecule is
  (a) 1   (b) 2   (c) 3   (d) 4

(viii) The number of valence shell electron in O^{2-} ion is
  (a) 4   (b) 6   (c) 8   (d) 10

(ix) Which of the following options represents the correct bond order
  (a) $O^{2-} > O^2 > O^{2+}$ (b) $O^{2-} < O^2 < O^{2+}$ (c) $O^{2-} > O^2 < O^{2+}$ (d) $O^{2-} < O^2 > O^{2+}$

(x) Number of chlorine atoms which form equatorial bonds in PCl_5 molecule are
  (a) 1   (b) 2   (c) 3   (d) 4

(xi) According to valence bond theory which of the following overlapping orbital is most stable
  (a) 1s-1s   (b) 2s-2s   (c) 2p-2p (head on overlapping)
  (d) 2p-2p ((sidewise overlapping)

(xii) The fiber obtained by the step polymerization of hexa-methylene-diamine & adipic acid is
  (a) Nylon   (b) Butyl rubber   (c) polystyrene   (d) Styrene

(xiii) PVC formed by
  (a) condensation polymerization   (b) Addition polymerization (c) vulcanization
  (d) none of these

(xiv) Which of the following is not addition polymer.

(a) PVC   (b) Nylon 6,6   (c) Polyethylene   (d) Polystyrene

(xv) The most commonly used reagent for vulcanization of natural rubber is

(a) Graphite   (b) Sulphur   (c) Adipic acid   (d) Ethylene

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

Column I (Name of fraction of crude oil)	Column II (uses)
(a) Petroleum ether	(i) As domestic fuel under the name LPG
(b) Gasoline	(ii) As for making roads
(c) Uncondensed gas	(iii) Used as Lubricant
(d) Asphalt	(iv) As motor fuel
(e) Grease	(v) As a solvent

(1x15) +5 = 20]

2. (a) A coal sample has the following composition by weight: C= 85%, O = 1%, S = 1% N = 2% and Ash 2%. Net calorific value of coal found to be 8500 Kcal/Kg. Calculate the percentage of hydrogen and high calorific value of coal.

(b) Define the term cracking in the context of fuel with a suitable example.

(c) Explain briefly the ultimate analysis of carbon in coal sample with proper chemical reaction.

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

[4+2 +2 +2 = 10]

3. (a) Explain the hybridization and geometry of PCl_5 and SF_6.

(b) Draw the molecular orbital energy diagram of N_2 molecule and using MO theory predict the bond order and magnetic behavior of N_2 and N_2^+.

(c) Using hybridization theory and valence shell electron pair repulsion theory justify the bond angle among CH_4, H_2O and NH_3 molecules.

[3 + (2+2) +3 = 10]

4. (a) Discuss the preparation of following polymers with proper chemical reaction.

(i) Nitrile rubber (Buna-N)   (ii) Polyethylene   (iii) Neoprene

(b) Explain the free radical mechanism for the formation of a polymer.

[(2x3) +4 =10]

****

S₁(UCE/ME/EE/CS/EC/EI/CH/PE/BE01C02) All

B.Tech 1st Semester Mid-Term Examination, 2016

Engineering Chemistry -1

Code: UCE/ME/EE/CS/EC/EI/CH/PE/BE/01**C02**

Time: **2 hours**

Full Marks: **50**

Answer ALL the questions below

The figures in the margin indicate full marks for the questions

1. (a) Define addition and condensation polymers with example.

   (b) Differentiate between thermoplastic and thermosetting polymers.

   (b) What is vulcanisation? Write down the advantages of vulcanisation.

   (c) Write down the monomeric units of (i) Neoprene (ii) Polyester

   [3+2+3+(1+1)=10]

2. (a) Explain the mechanism of free radical polymerisation

   (b) Explain the function of Ziegler-Natta catalyst for the polymerisation of ethylene.

   (c) How PAN is prepared? Mention its uses.

   [5+3+2=10]

3. (a) In the light of valence bond theory, draw the orbital model of ammonia.

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

       i) SF_4 ii) I_3^- iii) ClF_3

   (c) Why does *p*-nitrophenol have higher boiling point than *o*-nitrophenol?

   [2+(3×2)+2 =10]

4. (a) Discuss the hybridization and geometry of PCl_5 molecule.

   (b) Draw the molecular orbital (MO) energy level diagram of N_2 molecule. Write the MO electronic configuration of it. Calculate bond order and predict its magnetic behavior.

   [4+(3+1+1+1) =10]

5. (a) Define the following with example: (i) Octane number of fuel (ii) Cracking

   (b) Mention the uses of Asphalt and Paraffin wax

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

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

****

50

Time: 2 hours

Answer ALL the questions below

The figures in the margin indicate full marks for the questions

1. a) Draw the molecular orbital energy level diagram of O_2 molecule. Hence write the electronic configurations of the following species:
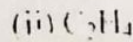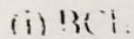
$$O_2^-, O_2^{2-}, O_2^+$$
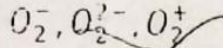
Arrange them in the order of their increasing (i) bond length (ii) bond energy.

b) Write the structure of CH_3^- and name its shape.

[(3+3+1+1)+2=10]

2. a) Predict the hybridization and geometry of the following molecules. Draw also their orbital diagrams.

    (i) BCl_3 (ii) C_2H_4

b) What is meant by vulcanization of rubber?

[{(1+1+2)+ (1+1+2)}+2=10]

3. a) Mention two characteristics of a good fuel. Arrange the following in the order of their decreasing antiknock property for a gasoline fuel.

     (x)-Isooctane   n-octane   iso-octane   α-methylnaphthalene
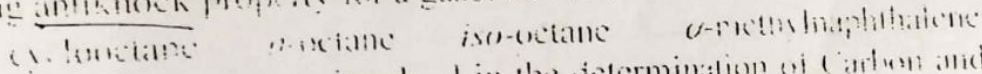
b) Write the chemical reactions involved in the determination of Carbon and Hydrogen in a given sample of coal. Mention the significance of the various reagents used in the above estimation. Give the formula for the percentage determination of the above elements.

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

4. a) "The octane number of a fuel is 60." What does it signify?

b) Define cracking giving a suitable example. Mention an important advantage of catalytic cracking over thermal cracking.

c) 1.0 g of a sample of coal was used for nitrogen estimation by Kjeldahl's method. The evolved ammonia was collected in 25 ml 0.1 N sulphuric acid. To neutralize excess acid, 15 ml of 0.1 N sodium hydroxide was required. Determine the percentage of nitrogen in the given sample of coal.

d) Give the structures and names of the monomers used in the preparation of the following polymers.

     i) Polyacrylonitrile   ii) Styrene rubber
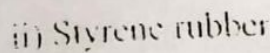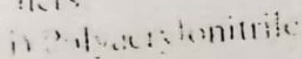
[1+(2+1)+2+(2+2)=10]

5. a) Discuss the cationic polymerization mechanism of addition polymerization.

b) Write two points of difference between Thermoplastic and Thermosetting polymers.

c) Name the synthesis of Xylocaine oxidation reaction. Also state its applications.

[4+2+(3+1)=10]

****

S(UCE/ME/EE/CS/EC/EI/CH/PE/BE01C02) All

B.Tech 1st Semester Mid Term Examination, 2014

Engineering Chemistry -1

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

Marks : 30

Time : 2 hours

The figures in the margin indicate full marks for the questions

Question number 1 is compulsory and answer any two from rest

1. (a) Write down the name and structure of the monomer(s) of : Natural rubber, Buna-S   [2]

(b) If the molar conductance at infinite dilution of NH_4Cl , NaOH, and NaCl are 129.8, 217.4, 108.9 $Ohm^{-1}cm^2mol^{-1}$ respectively. Calculate molar conductance at infinite dilution for NH_4OH.   [2]

(c) Define Buffer solution Explain the action of acidic buffer solution.   [2]

(d) Write down the hybridization of the following molecules: [2]

SF_6, PCl_5, C_2H_4, NH_4^+ (Copy)

(e) Write two important postulates of Molecular orbital theory. (775)   [2]

2. (a) Describe the free radical mechanism of addition polymerization.   [3]

(b) Write down the preparation, Properties and uses of Polyvinylchloride (PVC).   [1.5]

(c) Mention three distinguishing features between Thermoplastic and Thermosetting polymers.   [1.5]

(d) What do you mean by Vulcanization of Rubber? (Give the reaction of vulcanization of Rubber)   [1~1]

(e) Define addition and condensation polymerization. Give examples with suitable reactions)   [2]

3. (a) Discuss the postulates of VSEPR Theory.) (Copy)   [3]

(b) Arrange the following molecules according to their bond angles and justify with the help of VSEPR theory: H_2O, NH_3, CH_4 (Copy)   [1.5]

(c) He_2 molecule does not exist. Explain with the help of Molecular orbital theory.   [1.5]

(d) O_2 is paramagnetic whereas N_2 is diamagnetic. Explain with the help of Molecular orbital theory   [2]

(e) Arrange the following molecules according to their bond length.   [2]

O_2, O_2^-, O_2^{2-}