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B.TECH

(SEM II) THEORY EXAMINATION 2018-19

ENGINEERING CHEMISTRY

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. What is Schottky defect? Give examples.

b. What are Bio-degradable polymers? Discuss their importance.

c. Which stereo specific isomer of polypropylene can be prepared by Ziegler-Natta catalyst?

d. What is salt bridge? Mention its function in an electrochemical cell.

e. Why hardness is expressed in terms of $CaCO_3$ equivalents?

f. Calculate the no. of P, C and F in the following systems-

i. $NH_4Cl(S) \rightleftharpoons NH_3(g) + HCl(g)$ (open system)

ii. $NH_4Cl(S) \rightleftharpoons NH_3(g) + HCl(g)$ (closed system)

g. Why TMS is taken as a standard reference in NMR Spectroscopy.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. What do you understand by Mesomorphic state? Classify them on the basis of temperature and mention three important applications of it.

b. What are the limitations of raw rubber? Explain the process of vulcanization of rubber and mention the improvement in vulcanized rubber over raw rubber.

c. Discuss the electrochemical theory of corrosion. How corrosion is prevented by sacrificial anodic protection and impressed current cathodic protection.

d. Outline the salient features of the phase diagram of water system highlighting the name of system (areas, curves and points), phase in equilibrium and degree of freedom in each case.

e. Differentiate between Gross and Net calorific value of a fuel. A sample of coal contain C=89%, H=8% and ash=3%. The following data were obtained when the above coal was tested in bomb calorimeter**:**

Weight of coal burnt= 0.85 g
Weight of water taken= 650 g
Water equivalent of bomb and calorimeter= 2500 g
Rise in temperature= 2.5˚C
Fuse wire correction = 10 cal
Acid correction= 50.0 cal
Cooling correction= 0.03 ˚C
Calculate gross and net calorific values of the coal.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Draw the Molecular Orbital diagram of NO and O_2. Calculate its bond order and predict the magnetic behavior.

(b) Explain the preparation, properties and applications of an allotrope of Carbon having truncated icosahedron geometry.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) What are conducting polymers? Give the classification and mention their important applications.

(b) What are organomettalic compounds? Give the classification and applications of organomettalics.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Describe the electrochemical theory of corrosion on the basis of Hydrogen evolution and oxygen absorption mechanism.

(b) What is Portland cement**?** Give the chemical reactions involved during setting and hardening of cement.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Discuss the phase diagram of water system highlighting the name of system (areas, curves and points), phase in equilibrium and degree of freedom in each case.

(b) Calculate the amount of lime of lime and soda required for 1,00,000 liters of hard water with following analysis using 139 ppm of $FeSO_4.7H_2O$ as coagulant. The result of the analysis of raw water and softened water are as follows:
Raw water: Ca^{2+} = 160 ppm, Mg^{2+} = 288 ppm, HCO_3^- =1464 ppm ,Dissolved CO_2=20 ppm
Treated water: CO_3^{2-} =60ppm, OH^-=34 ppm

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) A compound having the molecular formula $C_{12}H_{14}O_4$ gave the following ^{1}H-NMR data- 2.6 ι (4H singlet), 5.6 ι (4H, quartet), 8.5 ι (6H, Triplet). Identify the compound based on proper explanation.

(b) How percentage of nitrogen can be estimated in coal? 1.56 gm of coal was kjeldahlised and the NH_3 gas evolved was absorbed in 50.0 ml 0f 0.1 N H_2SO_4. After absorption, the excess (residual) acid required 6.25 ml of 0.1 N NaOH for exact neutralization. Calculate the percentage of nitrogen in coal.