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B.TECH

(SEM II) THEORY EXAMINATION 2017-18

ENGINEERING CHEMISTRY

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

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

SECTION A

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

a. Calculate the bond order of N_2^+.

b. Graphite is a good conductor of electricity. Why?

c. What do you understand by the term functionality of a polymer? Explain by taking an example.

d. Give reactions of lead-acid storage cell when it behaves like a galvanic cell.

e. Explain why a pure metal rod half immersed vertically in water starts corroding at the bottom?

f. What is calgon conditioning? Explain.

g. A sample of coal contains 60% Carbon, 33% Oxygen, 6.0% Hydrogen, 0.5% Sulphur, 0.2% Nitrogen and 0.3% Ash. Calculate GCV and NCV of coal.

SECTION B

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

a. Explain Molecular Orbital Theory in case of metals and on its basis differentiate between conductors, semiconductors and insulators.

b. (i) Give preparation, properties and applications of BUNA N and Terylene.
(ii) Explain intrinsically conducting polymers.

c. (i) Give the construction and working of Galvanic cell.
(ii) Explain the different mechanisms of lubrication.

d. (i) A sample of water contains the following impurities:
Ca^{2+} = 20ppm, Mg^{2+} = 18 ppm, HCO_3^- = 183 ppm and SO_4^{2-} =24ppm. Calculate the lime and soda needed for softening.
(ii) Discuss the application of phase rule to water system.

e. (i) Calculate the minimum weight of air required for complete combustion of 1kg of fuel containing C = 90%, H = 3.5%, O = 3.0%, S = 0.5%, H_2O = 1%, N = 0.5% and ash = rest.
(ii) Give the composition of biogas. With the help of diagram, explain a biogas plant.

SECTION C

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

(a) (i) Explain Schottky and Frenkel defects in crystals.
(ii) Give the properties and applications of fullerenes.

(b) (i) Explain why O_2 is paramagnetic in nature.
(ii) Give the applications of nanomaterials in electronics and medicine.

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

(a) What are Grignard reagents? How are they prepared? Give its applications.

(b) What are composite materials? Give the classification of composite materials.

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

(a) Discuss the electrochemical theory of corrosion along with equations. Explain why sheets of Zinc metal are hung around the ship hull of ocean going ships.

(b) Explain the manufacturing process of cement. Give the chemical composition of Portland cement along with its setting and hardening.

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

(a) Explain the Zeolite process of water softening? The hardness of 10,000L of a sample of water was removed by passing it through a zeolite softener. The zeolite softener then required 200 L of NaCl solution containing 150 gm/L of NaCl for regeneration. Find the hardness of water sample.

(b) Explain the terms phase, components and degree of freedom with examples.

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

(a) Explain the term chemical shift along with shielding and deshielding. An organic compound with molecular formula $C_3H_3Cl_5$ gave the following proton NMR data: (i) A triplet 4.52 δ 1H (ii) A doublet 6.07 δ 2H

(b) What do you understand by the terms GCV and NCV? Explain the construction and working of bomb calorimeter.