

NEW SCHEME

CHE12/22

USN

First/Second Semester B.E Degree Examination, February/March 2005
Engineering Chemistry

Time: 3 hrs.] [Max.Marks : 100

Note: *i) Answer any FIVE full questions.*
ii) Draw neat diagrams wherever necessary.
iii) Answers must be specific and precise.

1. (a) What are liquid crystals? Explain the molecular ordering in the following liquid crystal phases. **(8 Marks)**

i) Nematic phase ii) Chiral nematic phase iii) Smectic phase.

(b) Explain the applications of liquid crystals in display systems and thermography. **(8 Marks)**

(c) Describe the biosynthesis of acetic acid. **(4 Marks)**

2. (a) Define gross and net calorific value of a fuel. Describe how the calorific value of a solid fuel is determined by using Bomb calorimeter. **(8 Marks)**

(b) Calculate the gross calorific value of a coal sample from the following data :

Weight of coal sample taken = $5.5 \times 10^{-3} kg$
Weight of water taken in the calorimeter = 2.5 kg
Water equivalent of calorimeter = 0.5 kg
Initial temperature of water = $24^0 C$
Final temperature of water = $28^0 C$ **(4 Marks)**

(c) What is knocking? What are its ill effects? Give the mechanism of knocking. How knocking can be prevented? **(8 Marks)**

3. (a) Derive Nernst equation for single electrode. Explain the determination of single electrode potential using standard hydrogen electrode. **(8 Marks)**

(b) Write brief notes on :

i) Calomel electrode ii) Glass electrode. **(8 Marks)**

(c) Write the electrode reactions and calculate the emf of the following cell at 298K given $E^0_{cell} = 1.3V$

$$Cu(S)|Cu^{2+}(1 \times 10^{-2} M)||Ag^{+}\ (1 \times 10^{-1} M)|Ag(S)$$ **(4 Marks)**

4. (a) Discuss on capacity and shelf life of a battery. Explain the construction and working of $Zn - MnO_2$ *cell*. **(8 Marks)**

(b) What are reserve batteries? Describe the construction and working of lead acid battery with reactions occurring during charging and discharging. **(8 Marks)**

(c) Describe the construction and working of methanol-oxygen fuel cell. **(4 Marks)**

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5. (a) What are the sources of oxides of nitrogen and sulphur? Mention their harmful effects. Indicate the measures to control them. **(8 Marks)**

(b) Calculate the COD of the effluent sample when $25cm^3$ of the effluent requires $10.5cm^3$ of 0.005M $K_2Cr_2O_7$ for complete oxidation. **(4 Marks)**

(c) Write brief notes on :

Ozone depletion ii) Global warming. **(8 Marks)**

6. (a) What is metallic corrosion? Explain the electrochemical theory of corrosion taking iron as an example. **(8 Marks)**

(b) Explain what type of corrosion occurs when

i) Screw and washer are made of different metals

ii) Presence of NaOH in mild steel boiler under stress. **(4 Marks)**

(c) Explain the effect of pH on the rate of corrosion. Write a brief note on cathodic protection. **(8 Marks)**

7. (a) What is electroplating? What are the advantages of electroless plating over electro plating? Explain the electroplating of Ni. **(8 Marks)**

(b) Explain electroless plating of copper on PCB's. **(4 Marks)**

(c) Discuss the role of the following factors on the nature of electro deposit

i) Current density

ii) Throwing power of the plating bath

iii) pH

iv) Addition agents. **(8 Marks)**

8. (a) What are polymers? Explain the free radical mechanism of addition polymerization taking ethylene as an example. **(8 Marks)**

(b) Define glass transition temperature and mention its significance. **(4 Marks)**

(c) Explain the manufacture of the following polymers and mention their uses.

i) Buna-S ii) Phenol formaldehyde. **(8 Marks)**

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