[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
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B. Tech 1st Semester Examination

Engineering Chemistry (NS)

NS-103

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : All sections are compulsory. Attempt five questions in all selecting one question from each section A, B, C & D of the question and all the subparts of Section E.

SECTION - A

1. (a) What do you understand by electrochemical series? How does it help in predicting whether a redox reaction is feasible or not? (4)

   (b) Give the constructional details of glass electrode. How can this be used for the determination of pH of a solution? (5)

   (c) Will zinc and silver react with 1M H_2SO_4 to give H_2 gas or not? (2)

   (d) What is fuel cell? Describe the construction and working of hydrogen oxygen fuel cell. (5)

   (e) A concentration cell is constructed by dipping two copper electrodes in 0.001M and 0.1M $CuSO_4$ and two solutions are connected by a salt bridge. Calculate the EMF of the cell at 298 K. (4)

2. (a) What is condensed phase rule? Why in such a case the phase rule equation is F=C-P+1? (4)

   (b) Construct and explain the phase diagram of lead-silver system. (10)

   (c) For one component system, triple point is invariant. Explain. (2)

   (d) Explain the terms eutectic point & eutectic mixture. (2)

   (e) In phase diagram of ice, fusion curve of ice has a negative slope whereas the sublimation curve has a positive slope. Why? (2)

SECTION - B

3. (a) What is Pilling Bedworth rule? Give its importance. (2)

   (b) Write a short note on:

   (i) Intergranular corrosion, (ii) Differential Metal Corrosion (3×2=6)

   (c) Explain rusting of iron with the help of electrochemical theory of corrosion. (8)

   (d) What is sacrificial anode? How does it protect a submerged pipeline? (4)

4. (a) What do you understand by hardness of water? What is its cause? Distinguish between carbonate and non-carbonate hardness of water. (5)

   (b) What are the different factors contributing to boiler corrosion? How can the boiler corrosion be minimized? (5)

   (c) Hardness of water always expressed in terms of $CaCO_3$ equivalents. Why? (2)

   (d) Justify the following:
   (i) COD is greater than BOD.
   (ii) Chloramine is a better disinfectant than bleaching powder. (3×2=6)

   (e) What is break point chlorination? Write its significance. (2)

SECTION - C

5. (a) What types of electronic transitions are involved in ultra violet and visible region? Discuss with suitable examples. (5)

[P.T.O.]

(b) A monochromatic radiation is incident on a solution of 0.01 M concentration of an absorbing substance. The compound transmits 20% of the radiation when the path length is equal to 1.5 cm. What is molar extinction coefficient of the substance? (5)

(c) What is coupling constant? How will you distinguish between a doublet and two peaks in NMR spectra? (3)

(d) What is the principle of IR spectroscopy? How will you distinguish between inter and intra hydrogen bonding? (5)

(e) Alkene chromophore is capable of exhibiting geometrical isomerism (*cis* and *trans*). Trans isomer displays longer wavelength absorption with higher intensity than corresponding *cis*-isomer. Why? (2)

6. (a) Explain proximate analysis of coal? How is it carried out? What is its significance? (7)

(b) What is significance of Octane number and Cetane number and for which these are used? How these can be improved? (3)

(c) What is meant by cracking of petroleum? Explain fluidized-bed catalytic method of obtaining gasoline. Give its mechanism. (8)

(d) "All coking coals are caking coals but all caking coals are not coking coal." Justify this statement. (2)

SECTION - D

7. (a) What is Ziegler Natta polymerization? Discuss its mechanism. How does it differ from other types of polymerization processes? (10)

(b) Why do all organic molecules not produce polymers? (2)

(c) Differentiate between thermosetting and thermoplastic polymers. (2)

(d) Explain synthesis and applications of

(i) Polyurethane

(ii) Epoxy resin (3×2=6)

8. (a) What are composites? Discuss important functions of matrix phase & disperse phase. (5)

(b) Calculate the fraction of load carried by the fibers in two composites of glass fibers and epoxy matrix one of them containing 20% fibers by volume and the one 60%. Elastic moduli for the glass fibers and the epoxy resin are 72 GN/m^2 and 3.6 GN/m^2, respectively. (5)

(c) What are glass fiber reinforced composites? Discuss important types of fiber reinforced composites. (5)

(d) Under what conditions fiber reinforced composites can fail? Discuss their failure modes. (5)

SECTION - E

9. (a) Why aluminium and its alloys are highly corrosion resistant below pH 7?

(b) What is the significance of sulphur in coal and how is it determined?

(c) In an ion exchange process, water is first passed through cation exchange resin and then anion exchange resin. But not vice versa. Why?

(d) Why do electrochemical cells stop working after sometime?

(e) IR spectra are often characterized as molecular fingerprints. Justify the statement.

(f) What is the effect of polarity of solvent on n-π^* and π-π^* transitions?

(g) Why polyvinyl chloride is stronger than polyethylene though both are linear chain polymer?

(h) Particle reinforced composites show better mechanical properties than short fiber reinforced polymer composites. Why?

(i) Why alloys are more resistant to corrosion than pure metals?

(j) Predict the number of components for decomposition of $CaCO_3$:

$CaCO_3$ (s) $\leftrightarrow$ CaO (s) + CO_2(g) (2x10=20)