

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]  
(2125)

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B. Tech 1st / 2nd Semester Examination

Chemistry (OS)

AS-1004

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 :** Attempt five questions in all, selecting one question each from Section A, B, C & D. Section E (question 9) is compulsory. (Each question carry 20 marks).

#### SECTION - A

1. (a) Derive Clapeyron - Clausius equation and discuss any two of its application. Under what condition this equation can be integrated? The vapor pressure of water at 95°C is 634 mm. What will be the vapor pressure at 100°C? Given that the molar heat of vaporization is 41270 J mol<sup>-1</sup>. (14)
- (b) Derive Gibbs-Helmholz equation and discuss its significance. (6)
2. (a) Determine the number of components, number of phases and degrees of freedom in the following equilibria:
  - (i)  $\text{NH}_4\text{Cl(s)} \rightleftharpoons \text{NH}_3\text{(g)} + \text{HCl(g)}$   
when  $P(\text{NH}_3) = P(\text{HCl})$
  - (ii)  $\text{NH}_4\text{Cl(s)} \rightleftharpoons \text{NH}_3\text{(g)} + \text{HCl(g)}$   
when  $P(\text{NH}_3) \neq P(\text{HCl})$
  - (iii)  $\text{N}_2\text{O}_4\text{(g)} \rightleftharpoons 2\text{NO}_2\text{(g)}$  (6)

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- (b) Explain following:
  - (i) Triple point (ii) Metastable equilibrium
  - (iii) Eutectic point (iv) Reduced phase rule (8)
- (c) Discuss the applications of phase rule in desilverization of lead giving suitable phase diagram. (6)

#### SECTION - B

3. (a) Write notes on—(i) Caustic embrittlement and (ii) Priming and foaming. What are internal and external treatments required for prevention of scale formation in boiler? (7)
- (b) What is meant by green house effect? How is it caused? What are its adverse effects on environment? (4)
- (c) Explain briefly—
  - (i) Disposal of radioactive wastes.
  - (ii) Aerobic and anaerobic oxidation.
  - (iii) Permanent and Temporary hardness. (6)
- (d) What are major disadvantages of using hard water for domestic purposes? (3)
4. (a) Explain how anodic and cathodic inhibitors provide protection against corrosion. Explain sacrificial anodic protection and impressed current cathodic protection method to control corrosion. (8)
- (b) Differentiate between dry and wet corrosion. Describe the mechanism of rusting of iron with the help of electrochemical theory of corrosion both in acidic and neutral medium. Why corrosion is faster in acidic medium? (8)
- (c) Write about pitting and waterline corrosion. (4)

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**SECTION - C**

5. (a) What are the criteria for a good lubricant? What type of lubrication is used in delicate machines like watches, sewing machine etc.? Explain its mechanism. Discuss extreme pressure lubrication and additive to improve the lubrication properties. (10)
- (b) Explain the followings:
- Saponification and iodine number.
  - Cloud and pour points.
  - Lubricating emulsion.
  - Aniline point.
  - Viscosity and viscosity index. (10)
6. (a) How is coal formed? Discuss different types of coal and their carbon content. Explain proximate and ultimate analysis of coal and write their significance. (10)
- (b) Explain the following:
- Characteristics of a good fuel.
  - Breeder reactor.
  - Octane number.
  - Catalytic reforming.
  - Biogas and its composition. (10)

**SECTION - D**

7. (a) Write on the following:
- |                          |                      |
|--------------------------|----------------------|
| (i) Auto catalyst        | (ii) Promoters       |
| (iii) Negative catalysis | (iv) Catalyst poison |
| (v) Enzyme catalysis     | (10)                 |
- (b) Discuss homogeneous and heterogeneous catalysis with examples. Explain adsorption theory of catalysis. How are they helpful in explaining the characteristic of catalytic reaction? (10)

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8. (a) In relation to NMR spectra, explain the following terms:
- Chemical shift
  - Shielding
  - Deshielding (6)
- (b) Explain electrical conductivity of solids based on band theory and explain semiconductors and insulators. (4)
- (c) Define spectroscopy. Explain the principle of NMR and IR spectroscopy. Also give applications of these techniques in case of organic compounds. (10)

**SECTION - E**

9. (a) What is calgon conditioning? How is it better than phosphate conditioning?
- (b) Indicate the significance of BOD and COD in sewage treatment.
- (c) Why does corrosion occur in steel pipe connected to copper plumbing?
- (d) Explain stress corrosion.
- (e) Why small amount of ethylene dibromide or ethyl bromide alongwith tetraethyl lead (TEL) is used in internal combustion engines?
- (f) What is the effect of pH on enzyme catalysis?
- (g) Explain the variation in conductivity of a semiconductor with rise in temperature.
- (h) Explain the effect of conjugation in structure on  $\pi \rightarrow \pi^*$  electronic transition.
- (i) What is entropy? How does entropy change in reversible and irreversible process?
- (j) What is break point chlorination? State its significance. (2×10=20)