

BT1/D05

8053

Chemistry (Common for all Branches)

Paper : CH-101E

Time : Three Hours]

[Maximum Marks : 100

Aggarwal Jagadhr

Note :— Attempt FIVE questions in all, selecting at least ONE from each unit. All questions carry equal marks.

UNIT—I

1. (a) Derive the Gibb's-Helmholtz equation. 5
(b) Will ΔS be + or - in the following processes ?
(i) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \xrightarrow{\text{aq.}} 2\text{HCl}(\text{aq.})$
(ii) $\text{H}_2\text{O}(\ell) \longrightarrow \text{H}_2\text{O}(\text{g})$
(iii) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g}).$ 3
(c) Define the term entropy. Explain its physical significance. 5
(d) 1 mol of an ideal gas at 27°C expands isothermally and reversibly from an initial volume of 2dm^3 to a final volume of 20dm^3 against a pressure that is gradually reduced. Calculate q , W , ΔE , ΔH , ΔA , ΔG and ΔS . 7
2. (a) State and explain the reduced phase rule equation. Write its physical significance. 4
(b) Name the metallurgist who introduced the term 'eutectic' in a two components system. 1
(c) Draw a neat, cleaned and labelled sketch of the phase diagram of water system. Discuss all the equilibria involved in it. 10

(d) Calculate ΔH , ΔG and ΔF in the following cases.

- (i) $\text{NH}_3(\text{g})$ at 42°C (ii) An emulsion of oil in water at 2 atm and 70°C (iii) $S_L \rightleftharpoons S_M$ at the transition temperature (iv) Pure crystals of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (v) Water system at 4.578 mm of Hg and at 0.0098°C .

UNIT—II *Aggarwal Jagadhril*⁵

(a) Distinguish between carbonate and non-carbonate hardness. Name the chemical compounds and their molecular structures imparting these hardness. 5

(b) State and explain the formation of Scales and Sludges during the formation of steam. Discuss their drawback, methods of preventing them. 10

(c) Why are the results of alkalinity or hardness always expressed in terms of CaCO_3 equivalents? 5

(d) Define the following units of hardness: ppm, degree of hardness and degree of hardness. Write the relationship among them. 5

(e) What is reverse osmosis? Name the various methods meant for this. Discuss in detail the electrolysis of sea water with the help of a neat, cleaned and labelled sketch of the apparatus. 10

(f) Discuss in detail the demineralisation of water using the ion exchange resin. Explain your answer by mentioning the chemical reactions occurring during demineralisation and regeneration processes. 6

(g) A water sample is alkaline both to phenolphthalein (HPh) and Methyl orange indicators. 100 ml of an alkaline water sample in presence of (HPh) consumes exactly 30 ml of $\text{N}/5 \text{HCl}$. However, the resulting mixture in presence of methyl orange consumes only 10ml of the same acid. Predict the types of alkalinities and their amounts in ppm as CaCO_3 equivalents. 6

UNIT—III

5. (a) Discuss extreme pressure lubrication and additives to improve the lubricant properties. 10

(b) Give the classification of lubricants with examples of each type. Specify the conditions under which each type is used.

6

(c) Write a short note on the determination and significance of flash point of an oil.

7

6 (a) What is stress corrosion? Give two examples of it.

6

(b) Explain the mechanism of H_2 evolution and O_2 absorption in electrochemical corrosion.

8

(c) How are the metals protected against corrosion by modifying the environment?

6

UNIT - IV

1. Describe the method of preparation, properties and some applications of calcium lactate.

3

2. Explain the mechanism of formation of free radicals. Discuss in detail the mechanism of formation of polymers starting with a vinyl monomer(s).

7

3. Differentiate between addition polymerisation and condensation polymerisation.

5

8. (a) Write a short note on any two:

(i) Acid base titration

(ii) Precipitation titration

(iii) Conductometric titration.

10

(b) Write a self explanatory note on Flame Photometry.

10