

238315(38)

Diploma in Engg. (Third Semester)  
Examination, Nov.-Dec. 2018

(Old Scheme)

(Branch : Metallurgy)

THERMODYNAMICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any five questions. All question carry equal marks.

1. (a) Define the term entropy and also explain 2nd law of thermodynamics. 4
- (b) Differentiate between :

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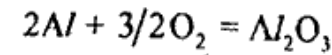
- (i) Irreversible and Reversible process
- (ii) Endothermic and exothermic reactions

Or

Define Gibb's free energy and write down the combined equation for 1st and 2nd law.

- (c) Give relation between free energy and equilibrium constant. 10

2. (a) Describe the term Metallurgical Thermodynamics. 2
- (b) Define the state of "Thermodynamic Equilibrium". 4
- (c) Derive Nernst equation. What are the applications of that equation? 4
- (d) Calculate standard entropy change of the following reaction at 1000 K. 10



Heat at fusion of Al at M.P. = 2500 Cal/Mol

$$\Delta S_{298}^{\circ} = -74.87 \text{ Cal/deg/Mol}$$

Given melting point of Al = 659°C.

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$$C_p \langle Al_2O_3 \rangle = 25.14 \text{ cal/deg/mol}$$

$$C_p \langle O_2 \rangle = 7.57 \text{ cal/deg/mol}$$

$$C_p \langle Al \rangle = 6.67 \text{ cal/deg/mol}$$

$$C_p \langle Al \rangle = 7 \text{ cal/deg/mol}$$

Or

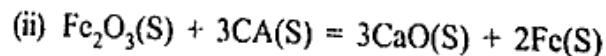
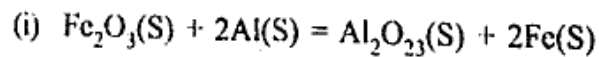
Explain the effect of temperature on rate of reaction.

3. (a) Distinguish between electrolytic cell and galvanic cell and also write down Hess law of constant heat summation and give its applications. 10

Or

Explain the factor's which affect the position of equilibrium.

- (b) Using the following value of free energy changes, calculate  $\Delta G_{298}^0$  for the following reactions : 10



Given  $\Delta G_{298}^0$  (KJ/mol) for different compounds

$$Fe_2O_3(S) = -741 \text{ KJ/mol,}$$

$$Al_2O_3(S) = -1576 \text{ KJ/mol,}$$

$$CaO(S) = -604 \text{ KJ/mol}$$

4. (a) Give short note on : (any three) 12

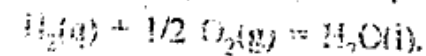
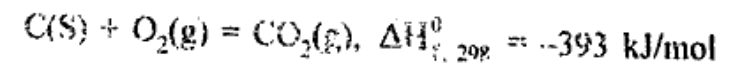
- (i) Desulphurisation
- (ii) Deoxidation
- (iii) Decarburization
- (iv) Activation energy

Or

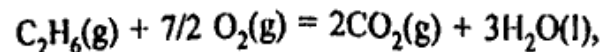
- (i) Define Internal Energy
  - (ii) Explain the term rate of reaction and also give the factor's which affect rate of reaction
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- (b) Derive Gibb's Duhem equation. 8

5. (a) Use following data to calculate the standard enthalpy change for the formation of ethane ( $C_2H_6$ ) at 298 K



$$\Delta H_{f, 298}^{\circ} = -286 \text{ kJ/mol}$$



$$\Delta H_{f, 298}^{\circ} = -1561 \text{ kJ/mol} \cdot 10$$

(b) Explain Faraday's law of electrolysis. 10

Or

State Raoult's and Henry law and what is (+)ve and (-)ve deviation in solution? Explain.

6. (a) Draw and explain free energy and temperature diagram also give its limitations and applications. 10

(b) Prove - Cp - Cv = R 5

(c) Define wt fraction and mole fraction? How to convert mole fraction into wt fraction? Give formula. 5

Or

If rate is increased by 2 times and concentration increases by 2 times find order of reaction.

7. (a) Give effect of Gibb's free energy, enthalpy and entropy on thermodynamics of mixing. 12  
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Or

Define :

- (i) Activity
- (ii) Activation energy
- (iii) Current efficiency
- (iv) Partial pressure
- (v) Mole fraction
- (vi) Fugacity

(b) What do you understand by the term chemical potential? Explain. 6

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