

**238315(37)**

**Dip. in Engg. (Third Semester)  
EXAMINATION, Nov.-Dec., 2019**

**(Scheme : Old)****(Branch : Metallurgy)****THERMODYNAMICS***Time : Three Hours ]**[ Maximum Marks : 100**[ Minimum Pass Marks : 35***Note : Attempt all questions.**

Q1. Define the following in short (any five) : 2 each

- Enthalpy
- Molar heat capacity
- Specific heat
- Current density in electrolysis
- Intensive thermodynamic properties
- Phases

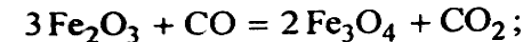
(A-26) P. T. O.

2. Classify the thermodynamic system on the basis of number of components of the system. Explain any one with suitable example. 10

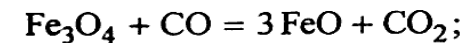
*Or*

Define state and path property. How a thermodynamic property is verified to be a state or path property ?

- Q3. (a) What is the relation between Joule and Calorie ? 2  
(b) The reduction of iron oxide in blast furnace proceeds according to the following reactions : 8



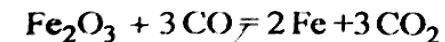
$$\Delta H_{298}^\circ = -12.7 \text{ kcal}$$



$$\Delta H_{298}^\circ = +9.8 \text{ kcal}$$



Calculate  $\Delta H_{298}^\circ$  for the reaction :



- Q4. Derive the expression for workdone in adiabatic process. 10

*Or*

Derive the expression for workdone and change in enthalpy for the isothermal process.

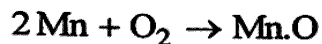
(A-26)

[ 3 ]

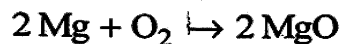
238315(37)

5. Draw the Ellingham diagram for any *two* of the following : 5 each

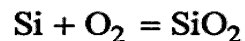
- (a) To determine  $\frac{\text{CO}}{\text{CO}_2}$  ratio at 1000 K for the reaction :



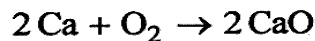
- (b) To determine  $\Delta H_{298}^\circ$  for the reaction :



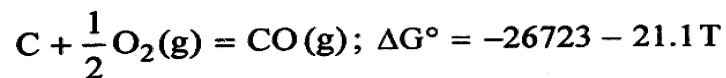
- (c) To determine  $\frac{\text{H}_2}{\text{H}_2\text{O}}$  ratio at 1200 K for the reaction :



- (d) To determine  $\text{PO}_2$  at 1100 K for the reaction :



6. Write the equilibrium constant relation for the relation : 10



Discuss the effect of temperature and pressure on the given reaction.

Or

Derive the Clausius-Clapeyron's equation for solid to liquid transformation of matter and discuss the effect of pressure on transformation temperature.

(A-26) P. T. O.

[ 4 ]

238315(37)

7. Derive the expression for the free energy of an ideal solution, having (*n*) number of components. 10

Or

Define partial molal and quantities and derive Gibbs-Duhem's equation. 10

8. Describe the factors affecting the rate of a reaction. Explain the effect of each *one* upon the rate equation. 10
9. (a) What is deoxidation ? What are the common deoxidisers and its use ? 5  
 (b) Describe Degassing principle of molten metals. 5
10. (a) What is EMF series and its importance ? 5  
 (b) What are the factors affecting current efficiency of a electrolytic cell ? Explain. 5

238315(37)

480

(A-26)