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C20-MET–402

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023

DMET – FOURTH SEMESTER EXAMINATION

METALLURGICAL THERMODYNAMICS

Time : 3 Hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Define state of a system and equation of state.

2. State the equation for work of expansion.

3. State heat capacity-temperature relationships.

4. Define heat of combustion.

5. Define entropy change and phase change.

6. Draw ΔG° – T diagram in terms of the formation of CO.

7. Find ΔHv of zinc, if melting point of zinc is 420 °C by using Trouton's rule.

8. Define chemical equilibrium.

9. Define ideal solution and regular solution.

10. State Sievert's law.

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Derive heat changes at constant volume and constant pressure.

(OR)

(b) Derive the pressure-volume relationship in reversible adiabatic process.

12. *(a)* Define exothermic and endothermic reactions, heat of formation and heat of combustion also, give the sign conventions of from ΔE.

(OR)

(b) The reduction of iron oxide in the blast furnace process is according to the following reactions, at 298 K :

$3Fe_2O_3 + CO = 2Fe_3O_4 + CO_2$; $\Delta H° = -12.7$ kcal

$Fe_3O_4 + CO = 3FeO + CO_2$; $\Delta H° = 9.8$ kcal

$FeO + CO = Fe + CO_2$; $\Delta H° = -4.4$ kcal

Then, calculate $\Delta H°_{298}$ for $Fe_2O_3 + 3CO = 2Fe + 3CO_2$

13. *(a)* Explain the conditions for equilibrium in terms of change in free energy.

(OR)

(b) Derive the Gibbs-Helmholtz equation.

14. *(a)* Derive the Clasius-Clapeyron equation and explain its applications.

(OR)

(b) Explain the equilibrium between phases of one component system.

15. *(a)* Explain the factors effecting the position of equilibrium.

(OR)

(b) Derive the vant Hoff's equation for isotherm.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Draw a thermodynamic cycle on P-V diagram which consists of 2 isothermal processes and 2 reversible adiabatic processes and label all the processes and state coordinates.

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