TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021

PHYSICS

(3rd Semester)

Course No. : PHSDSC/PHSGE–301T

(Thermal Physics and Statistical Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *fifteen* of the following questions : 1×15=15

1. State zeroth law of thermodynamics.

2. Is internal energy a state function?

3. Which thermodynamic process is also called an isentropic process?

4. Name the thermodynamic process for which $\Delta W = 0$.

5. Define entropy.

6. In which states of matter, entropy is maximum?

7. Define internal energy.

8. Define Gibbs' function.

9. Define Helmholtz function.

10. Write Clausius-Clapeyron equation.

11. During free expansion, which thermodynamic function does not change?

12. What is Joule-Thomson effect?

13. Define mean free path.

14. Write down Maxwell's expression of mean free path.

15. What is diffusion?

16. What do you mean by transport phenomena?

17. What is the effect of temperature on viscosity?

18. At which temperature, all molecular motions cease?

19. What is a perfect blackbody?

20. What is black-body radiation?

21. Why does a blackbody appear black?

22. State Stefan's law.

23. State Wein's distribution law.

24. Who resolved ultraviolet catastrophe?

25. What is statistical mechanics?

26. Define macrostate.

27. Write down the relation between entropy and thermodynamic probability.

28. Name one particle which obeys FD statistics.

29. Who formulated quantum statistics?

30. State Maxwell-Boltzmann law.

SECTION—B

Answer any *five* of the following questions : 2×5=10

31. Why is C_P greater than C_V?

32. Distinguish between reversible and irreversible processes.

33. Deduce Clausius-Clapeyron equation using Maxwell's relation

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

34. In a throttling process ($Q = 0$), the system suffers no change in enthalpy. Justify.

35. State the assumptions of kinetic theory.

36. How does mean free path vary with temperature and pressure?

37. A perfect blackbody is the best possible emitter. Justify.

38. What are the assumptions made by Planck to deduce Planck's radiational law?

39. Name the particles which have zero or integral spin. Give an example of such particle.

40. What are the assumptions of MB distribution?

SECTION—C

Answer any *five* of the following questions : 5×5=25

41. Find the expression of work done during an adiabatic process.

42. Show that for a reversible cyclic process, the total change of entropy is zero.

43. Using Maxwell's relation, prove that

$$\left(\frac{\partial C_v}{\partial V}\right)_T = T\left(\frac{\partial^2 P}{\partial T^2}\right)_V$$

44. Prove that

$$U = F - T\left(\frac{\partial F}{\partial T}\right)_V$$

45. Find the expression of diffusion coefficient D.

46. Explain the different types of transport phenomena citing examples.

47. Deduce Planck's radiational law.

48. Deduce Wein's distribution law.

49. Establish the relation $S = k\log\Omega$.

50. Deduce Maxwell-Boltzmann distribution law.

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