LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

SECOND SEMESTER – **NOVEMBER 2016**

PH 2505 – MECHANICS & STATISTICAL PHYSICS

Date: 12-11-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART – A

Answer All Questions. **(10 X 2 = 20 MARKS)**

1. Define Moment of Inertia.
2. State the Fick's law of diffusion.
3. Give an example and the corresponding constraint equation for holonomic and non-holonomic constaints.
4. Write the equation of constraint and the transformation equation for a particle constrained to move on a sphere.
5. Calculate the number of collisions per second of a gas having mean free path $\lambda=1.876\text{x}10^{-7}$ m. The average speed of the molecule is 511m/s.
6. Show that the coefficient of self-diffusion is directly proportional to $T^{3/2}$ and inversely proportional to pressure if $D=1/3c\,\lambda$.
7. Write down the Maxwell's Thermodynamical relations.
8. Define second order phase transition. Give examples.
9. Define Thermodynamic probability.
10. State the limitations of Maxwell-Boltzmann statistics.

PART – B

Answer ANY FOUR Questions. **(4 x 7.5 = 30 marks)**

11. Show that the time of diffusion from one distribution of concentration to another in a given solution is directly proportional to the square of the length of its column. (7.5)
12. Discuss the motion of a particle in a central force field using Hamiltonian equation. (7.5)
13. Derive the Clausius expression for mean free path. (7.5)
14. Obtain Clausius – Clapeyron's latent heat equation using the relevant Maxwell's thermodynamical relation. (7.5)
15. Derive the Maxwell Boltzmann law of energy distribution and obtain an expression for the Boltzmann factor. (7.5)

PART C

Answer ANY FOUR questions **(4 x 12.5 = 50 marks)**

16. Derive an expression for the time period of a compound pendulum. Explain the condition for the period to be minimum. (10+2.5)

17. Explain D'Alembert's principle and derive the Lagrange's equation using the same. (4+8.5)

18. Derive an expression for thermal conductivity of a gas on the basis of kinetic theory of gases. Discuss the coefficient of thermal conductivity of hydrogen molecule and comment on the same. (8.5+4)

19. Explain Joule-Thomson effect using the Maxwell's thermodynamical relations and prove its absence for a perfect gas. (10.5+2)

20. Applying Maxwell's law of distribution of speeds of molecules in a gas, obtain expressions for average speed, root-mean square speed and most probable speed. (12.5)

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