LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2012

# PH 3505/3503 - THERMODYNAMICS

Date : 05/11/2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

**PART – A**

Answer **ALL** questions. (10 × 2 = 20 marks)

1. State the law of equipartition of energy in a gas.
2. If the density of nitrogen is 1.25g/litre at NTP, calculate the rms velocity of its molecules.
3. Distinguish between adiabatic and isothermal changes.
4. What is meant by superfluidity?
5. Define intensive and extensive variables with examples.
6. Give Clausius statement of second law of thermodynamics.
7. Define Helmholtz and Gibbs functions.
8. What is Joule-Kelvin effect? Give its most important application.
9. What do you mean by micro and macro states?
10. What do you understand by black body radiation?

**PART – B**

Answer any **FOUR** questions. (4 × 7.5 = 30 marks)

11. (a) Define mean free path. (2)

(b) Derive an expression for the mean free path of molecules in a gas. (5.5)

12. (a) What is the principle involved in the liquefaction of gases? (2.5)

(b) Explain Linde’s experimental method of liquefying air. (5)

13. (a) Write down the coefficient of cubical expansion and compressibility of a gas in

terms of partial derivatives. (1.5+ 1.5)

(b) Derive the expressions for coefficient of cubical expansion and compressibility

of an ideal gas. (2+2.5)

14. (a) Explain the concept of entropy. (2.5)

(b) Deduce the expression for the efficiency of the Carnot’s engine with suitable diagram. (5)

15. (a) Explain the term phase-space. (3)

(b) Obtain a relation connecting entropy and thermodynamic probability. (4.5)

**PART – C**

**Answer any FOUR questions: (4× 12.5 = 50 marks)**

16. (a) What do you understand by transport phenomena? (2)

(b) Derive an expression for the viscosity of a gas in terms of mean free path of its molecules. Discuss the effect of pressure and temperature on coefficient of viscosity. (7.5+1.5+1.5)

17. (a) Describe, with experimental arrangement, Clement and Desormes method of determining γ,

the ratio of heat capacities. (10.5)

(b) Calculate the values of the molar heat capacities of a gas if γ=1.33 and R = 8.31J/mol-K. (2)

18. (a) Derive Clausius –Clapeyron’s latent heat equation. (7)

(b) Establish the Clausius inequality for a cyclic process. (5.5)

19. (a) Derive an expression for the Joule- Kelvin coefficient and show that it is zero

for an ideal gas. (7+3)

(b) Discuss temperature of inversion. (2.5)

20. (a) Derive Planck’s law of radiation. (8.5)

(b) Hence deduce Wien’s law and Rayleigh – Jeans law for shorter and longer wavelengths. (2+2)

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