2009-2010

B.Sc. (Hons.) (PART – III) EXAMINATION

(PHYSICS)

THERMAL AND STATISTICAL PHYSICS

(PH-304)

Maximum Marks: 40 Duration: Three Hours

Note: Answer all questions. The marks allotted to a question are shown against it. The symbols have their usual meanings.

1. Assuming a real gas to obey Van der Waals' equation, obtain the critical constants in terms of the parameters of the equation. (7)

OR

1′ Name three phenomena that go under the general name of Transport Phenomena. Briefly describe the simple theory of any one of these. 1 ½ + 5 ½

2. (a) State and explain what the First Law of Thermodynamics says. (2)

(b) Explain the meaning of the following equation (2)

$$Q=U_f - U_i + W,$$

Where Q is the heat supplied to a system; U stands for the internal energy of the system and W the work done, i standing for the initial state and f the final state.

(c) Describe Joule's free expansion. What happens when a real gas undergoes Joule's free expansion? (3)

3 Starting from first principles, obtain the efficiency of a Carnot Engine. What is its maximum value and when can it be achieved? (4+2)

4 With the help of the necessary formulae, discuss production of low temperatures by the adiabatic demagnetization of a paramagnetic substance. (4)

How the temperature in the range of 20^0-10^0K measured? (2)

OR

4′ Starting from first principles, obtain the Clausius-Clapeyron Equation. Use it to qualitatively discuss the change in the melting point of ice-due to increase of pressure. 4+2

5 (a) Give the dimension of the phase space of a 10-particle system confined to move on a plane. (2)

(b) Explain micro-and macro-states (3)

(c) Distinguish between the classical and B-E statistics. (2)

Contd....2

6 (a) Discuss the theory of quantized linear oscillator and derive an expression for the average fractional number oscillators in an energy level.

(b) Draw a graph of experimental values of Cv/R for a diatomic gas as a function of temperature and discuss its features in terms of the characteristic temperatures for rotation and vibration. 5+2

OR

6′ Starting from first principles, obtain the Planck distribution formula for Black Body Radiation. Obtain the Rayleigh-Jean's formula as a limiting case of Planck's formula. 5+2

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