

TB165415D

Reg. No.:

Name :

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2018
(2016 Admission Regular & 2015 Admission Supplementary)
SEMESTER V- CORE COURSE (PHYSICS)
PH5B07TB – THERMAL AND STATISTICAL PHYSICS

Time: Three Hours

Maximum Marks: 60

PART A

I. Answer all questions. Each question carries 1 mark.

1. What is the amount of heat energy given to a system when it undergoes a cyclic process?
2. What change occurs to the entropy of a system which undergoes a reversible process?
3. Give the physical significance of the thermodynamic potential enthalpy.
4. Write down the relation between entropy and thermodynamic probability.
5. What is meant by indistinguishability of identical particles?

(5 × 1 = 5)

PART B

II. Answer any five questions. Each question carries 2 marks.

6. What is an indicator diagram? Give the indicator diagram for an Carnot engine.
7. Derive the relation between adiabatic and isothermal elasticities?
8. What is the Helmholtz function? It is also called the work function, why?
9. Explain the concept of entropy and disorder.
10. What do you mean by ultraviolet catastrophe?
11. Distinguish between position space, momentum space and phase space.
12. Explain the principle of equal a priori probability with the help of an example.
13. Explain the terms macrostate and microstate in statistical physics.

(5 × 2 = 10)

PART C

III. Answer any five questions. Each question carries 5 marks.

14. A motor car tyre has a pressure of 3 atmospheres at the room temperature of 27°C. If the tyre suddenly bursts, what is the resulting temperature ($\gamma=1.4$).
15. The efficiency of a reversible heat engine is 25%. If the temperature of the source is increased by 300K, its efficiency will be doubled. Calculate the temperatures of the source and sink.
16. Derive the first T-dS equation.
17. Show that the Gibbs function remains constant when a system undergoes an isothermal and isobaric process.
18. Calculate the pressure at which water would freeze into ice at -1°C, if the change in specific volume when 1kg of water freezes into ice is $9.1 \times 10^{-5} \text{ m}^3$. Specific latent heat of fusion of ice = $3.3 \times 10^5 \text{ J/kg}$, 1 atmosphere = $1.013 \times 10^5 \text{ Pa}$.
19. In a system of 8 distinguishable particles distributed in two equally sized compartments,

- calculate the probability of the macrostates (3, 5), (4, 4) and (2, 6)
20. Discuss the need for a statistical ensemble? Explain about the different types of ensembles.
 21. Compare the three statistics and show that the M-B distribution is a limiting case of B-E and F – D statistics.

(5 × 5 = 25)

PART D

IV. Answer any two questions. Each question carries 10 marks.

22. What is a Diesel engine? Explain the working of a Diesel engine.,using an indicator diagram. Arrive at an expression for its efficiency.
23. State and explain first law of thermodynamics. Apply the law to derive $C_p - C_v = R$.
24. What do you mean by a black body? Describe the experiment performed by Lummer and Pringsheim and discuss the distribution of energy in the spectrum of a black body.
25. What are bosons? Derive an expression for the most probable distribution of a system of particles obeying Bose – Einstein statistics.

(2 × 10 = 20)