

TB145670A

Reg. No:.....

Name.....

B. Sc. DEGREE (C.B.C.S.S) EXAMINATION, OCTOBER 2016
SEMESTER V - PHYSICS
PHY5TSP - THERMAL AND STATISTICAL PHYSICS

Time: Three Hours

Maximum Marks: 60

PART A

Short answer questions

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

1. Explain the first law of thermodynamics.
2. What is an indicator diagram? State its importance.
3. What is the principle of unattainability of absolute zero?
4. Define entropy. Write down an expression for entropy in adiabatic process.
5. Give the concept of isothermal elasticity.
6. State the Wien's displacement law.
7. Give the concept degenerate energy levels.
8. Explain the need of quantum statistics.

(8x1 = 8)

PART B

Brief answer questions

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

9. Derive an expression for the work done in during isothermal process.
10. What is a heat engine? What are its essential parts?
11. Derive an expression for the change in temperature of a metallic wire when it is stretched.
12. State and prove Carnot's theorem.
13. State and explain second law of thermodynamics.
14. Write down Clausius Clepeyron equation. Explain the terms.
15. Explain the different modes of heat transfer with examples.
16. What is meant by Micro and Macro states?
17. Explain the consequences of indistinguishability of particles in quantum statistics.
18. How we can apply Fermi-Dirac Statistics to electron gas.

(6x2 = 12)

PART C

Short essay questions

III. Answer any four questions. Each question carries 4 marks.

19. A monatomic ideal gas of volume 1 litre and pressure 8 atmosphere undergoes adiabatic expansion until the pressure drops to 1atmosphere. What is the final volume and how much work is done? $1\text{atms} = 10^5\text{Nm}^{-2}$.
20. A Carnot engine has an efficiency of 30% when the temperature of the sink is 27°C . What must be the change in temperature of the source to make its efficiency 50%.

21. A Carnot reversible engine working between the temperatures 500 K and 300 K. Suppose 1000 joules of heat energy is drawn from the high temperature reservoir. Prove the Clausius Inequality $\oint \frac{dq}{T} = 0$.
22. Calculate the probability that in tossing a coin 10 times, we get (i) all heads (ii) 5 heads & 5 tails.
23. The average kinetic energy of a gas molecule at a certain temperature is 6.21×10^{-21} joules. Find the temperature. Boltzmann's constant $K = 1.38 \times 10^{-23}$ joule K^{-1} .
24. Briefly compare the results of M.B, B.E and F.D statistics.

(4x4 = 16)

PART D

Essay type questions

IV. Answer any two questions. Each question carries 12 marks.

25. Describe with necessary theory the working of a Petrol (Otto) engine. Calculate the efficiency of the engine.
26. Define thermodynamic potentials. Derive Maxwell's thermodynamical general equations connecting the thermodynamic quantities.
27. Define coefficient of thermal conductivity. Describe the Lee's method to find the coefficient of thermal conductivity of metals.
28. Derive Plank's law of black body radiation using Bose Einstein statistics.

(2x12 = 24)