T – 3189

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, August 2024

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1231.1 : THERMAL PHYSICS AND STATISTICAL MECHANICS

(2023 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences.

1. State Planck's hypothesis.

2. What is thermometric conductivity?

3. What is available energy?

4. What is the efficiency of a heat engine?

5. An inflated car type gets heated up during running. Why?

6. What is adiabatic process?

7. State wien's displacement law.

8. Define macrostates.

9. Ice when heated melts. Does this correspond to an increase or decrease in disorder.

10. What is ensemble?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions.

11. What is coefficient of thermal conductivity?

12. Differentiate good and bad conductors with examples.

13. State Widemann and Franz law.

14. Derive the relation between isothermal elasticity and adiabatic elasticity.

15. Explain microstates with examples.

16. How is entropy and disorder related?

17. Explain distribution of energy in black body spectrum.

18. State the second law of thermodynamics.

19. Show that adiabatics are steeper than isothermals.

20. Draw the T-S diagram for Carnot's cycle.

21. Obtain Rayleigh – Jeans from Planck's law of radiation.

22. Explain phase space.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions.

23. A carnot's engine 2000 J of heat from a reservoir at 500 K does some work and discards some heat to a reservoir at 350 K. How much work does it perform and how much heat is discarded? What is its efficiency?

24. Define solar constant. Determine the solar temperature.

25. A perfect gas is compressed to $1/4^{th}$ of its original volume. The initial pressure of the gas is 1 atm. Calculate the final pressure if the compression is

   (a) isothermal

   (b) adiabatic. Given $\gamma = 1.5$.

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26. Calculate the change in entropy when 5 kg of water at 100°C is converted into steam at the same temperature.

27. Show that the entropy of a system is proportional to the logarithm of probability of that system.

28. An ice box is built of wood 1.75 cm thick, lined inside with cork 3 cm thick. If the temperature of inner surface of the cork is 0°C and that of the outer surface of wood is 12°C, what is the temperature of the interface? The thermal conductivity of wood and cork are 0.0006 and 0.00012 CGS units respectively.

29. Calculate the surface temperature of the sun and moon. Given that wavelength of Maximum intensity emission is 4753 Å and 14 μ respectively. Given $b = 2898$ cm- deg.

30. Two particles are to be accommodated in three available quantum states. Find the number of ways in which this can be done according to Maxwell – Boltzmann statistics.

31. A Petrol engine consumes 25 kg of petrol per hour. The calorific value of petrol is 11.4×10^6 cal/kg. The power of the engine is 99.75 k watts. Calculate the efficiency of the engine.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions.

32. Describe with necessary theory, the construction and working of a Diesel engine. Obtain its efficiency. Enumerate its merits over petrol engine.

33. Explain with necessary theory how thermal conductivity of a poor conductor is determined by Lee's Disc method.

34. Explain the concept of entropy. Discuss the change of entropy in reversible and irreversible process.

35. (a) Enumerate the postulates of Equal Probability.

    (b) Derive the Maxwell Boltzmann Distribution.

(2 × 15 = 30 Marks)