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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, May 2020.

First Degree Programme Under CBCSS

Physics

Complementary Course for Statistics

PY 1231.3 – THERMAL PHYSICS AND STATISTICAL MECHANICS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in one or two sentences. Each question carries **1** mark.

1. What are the modes of transfer of heat from one place to another?

2. State Wiedermann-Franz law.

3. What is expression for Isothermal elasticity?

4. Name the operations in a carnot cycle in the order of occurrence?

5. Mention the Claussius statement.

6. Define entropy.

7. Is a process with decrease in entropy of an isolated system possible?

P.T.O.

8. Give the expression for entropy of a perfect gas in terms of temperature and volume.

9. State Plank's Radiation law.

10. What is an ensemble?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions not exceeding a paragraph. Each question carries **2** marks.

11. What is an indicator diagram?

12. What are the conditions for reversibility of a heat engine?

13. The change in entropy of an adiabatic process is zero.Why?

14. What is the physical significance of entropy?

15. Distinguish between conduction and convection.

16. Explain the Lee's disc method for a bad conductor.

17. Distinguish between Maxwell- Boltzmann statistics and Bose-Einstein statistics

18. State and explain the Principle of equal A priori probability.

19. What is the condition for the application of MB statistics?

20. What are the basic postulates of Bose Einstein Distribution law?

21. Prove that the slope of adiabatic is γ times the slope of the isothermal.

22. Explain Grand canonical ensemble.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

23. The opposite faces of A metal plate of 0.2 cm thickness are at a difference of temperature of 100°C and the area of the plate is 200 sq cm. Find the quality of heat that will flow through the plate in one minute if K=0.2 CGS units.

24. A motor car tyre has a pressure of 2 atmospheres at the room temperature of 27°C If the tyre suddenly bursts, find the resulting temperature.

25. Find the efficiency of the Carnot's engine working between the steam point and ice point.

26. A Carnot's engine whose lower temperature heat -sink is at 27°C has its efficiency 40%.What is the temperature of the heat source. By how much should the temperature of the source would be raised if the efficiency is to be raised to 70%.

27. Calculate the change in entropy when 5kg of water at 100°C is converted into steam at the same temperature.(Given ; Latent heat of steam = 540 cal/gram)

28. Calculate the change in entropy of 1 gram of nitrogen when its temperature rises from 50°C to 100°C while its volume is kept constant. Molar specific heat, C_v = 0.18 and molecular weight of nitrogen is 28.

29. A Carnot's engine whose temperature of the source is 400 K takes 200 calories of heat at this temperature and rejects 150 calories of heat to the sink. What is the temperature of the sink? Also calculate the efficiency of the engine.

30. 1 gram molecule of a monoatomic (γ = 5/3) perfect gas at 27°C is adiabatically compressed in a reversible process from an initial pressure of 1 atmosphere to a final pressure of 50 atmosphere. Calculate the resulting difference in temperature.

31. Efficiency of Carnot's cycle changes from 1/6 to 1/3 when source temperature is raised by 100K. Calculate the temperature of the sink.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

32. (a) What is a heat engine?

    (b) Explain the important parts of a Carnot's heat engine with diagram.

33. (a) Explain the operation of Carnot's engine and refrigerator.

    (b) What is meant by coefficient of performance of a refrigerator.

34. Obtain the expression for entropy of a perfect gas in terms of

    (a) temperature and volume

    (b) temperature and pressure

    (c) pressure and volume

35. (a) Obtain the general equation for Maxwell-Boltzmann distribution law.

    (b) What is MB energy distribution function for an ideal gas?

(2 × 15 = 30 Marks)
