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Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2021.

First Degree Programme under CBCSS

Physics

Core Course – I

PY1341 - THERMODYNAMICS AND STATISTICAL PHYSICS

(2013, 2015 – 17 Admn)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Find the efficiency of a heat engine that absorbs 2000 J of energy from a hot reservoir and exhausts 1500 J to a cold reservoir.

2. Obtain the dimensions of coefficient of thermal conductivity.

3. What is the unit of entropy?

4. The rate of radiation of black body at 0°C is E watt. Then the rate of radiation of this black body at 273°C will be

5. An example of Boson is _____

6. In a toss of 4 coins a macro state with 2 Heads has _____ number of microstates.

7. Write Clausius - Clapeyron equation

P.T.O.

8. Define Gibb's function.
9. State Zeroth law of thermodynamics.
10. Define solar constant.

(10 × 1 = 10 Marks)

SECTION – B

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

11. Explain the concept of macro states and micro state.
12. State Wiede mann-Franz law.
13. State and explain first law of thermodynamics
14. Rate of formation of ice in lakes decreases with increase in the thickness of ice layer. Why?
15. Explain principle of increase of entropy?
16. An electric refrigerator transfers heat from low temperature to the surroundings at high temperature. Does this violate second law of thermodynamics? Explain
17. When a tyre bursts, the air coming out is cooler than the surrounding air. Why
18. Which is more effective way to increase the efficiency of Carnot engine
    (a) Increase T_1 keeping T_2 =constant
    (b) decrease T_2 Keeping T_1 constant? Give the reason?
19. Explain the lambda transition of liquid Helium
20. What is Bose - Einstein condensation?
21. Discuss the relation between entropy and disorder.
22. Nine particles have speeds of 5.00, 8.00, 12.0, 12.0, 12.0, 14.0, 14.0, 17.0. and 20.0 m/s.
    (a) Find the particles' average speed
    (b) r.m.s speed

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** question. Each Carries **4** Marks

23. Show that slope of the adiabatic process at any point is γ times slope of isothermal where γ is the ratio of specific heat.

24. A gas is expand adiabatically with the initial pressure and volume are 10^6 Pa and $10^{-3}m^3$. respectively, and the final values are 2×10^5 Pa and 3.16×10^{-3} m, respectively. How much work is done on a gas having $\gamma = 1.4$?

25. Three Carnot engines operate between temperature limits of

    (a) 400 and 500 K,

    (b) 500 and 600 K, and

    (c) 400 and 600 K.

    Each engine extracts the same amount of energy per cycle from the high-temperature reservoir. Rank the magnitudes of the work done by the engines per cycle, greatest first.

26. One face of a copper cube of edge 10 cm is maintained at 100 °C and the opposite face is maintained at 0 °C. All other surfaces are covered with insulating material. Find the amount of heat flowing per second through the cube. Thermal conductivity of copper is 385 $Wm^{-10}{}^{\circ}C^{-1}$.

27. Calculate rms speed, most probable speed and average speed of oxygen molecule at 27 °C. Molar mass of oxygen is 32 u.

28. In a gas of atomic hydrogen at 0°C . What is the number of atoms in the first excited state at E = 10.2 eV. expressed as a ratio to the number in the ground state? (b) At what temperature would we expect to find 1/10 as many atoms in the first excited state as in the ground state?

29. Three particles are to be distributed in four energy levels. Calculate the possible ways of distribution if the particles are

    (a) Bosons

    (b) Fermions

    (c) Classical particles.

30. Obtain the expression for work done in a

(a) Isothermal Process

(b) Adiabatic Process.

31. Distinguish between first order and second order phase transition with example

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each carries **15** Marks.

32. Discuss the Otto cycle and obtain the expression for the efficiency.

33. Define Entropy. What is its physical significance? Show that the entropy of a perfect gas remains constant in reversible process but increase in an irreversible process.

34. State and explain Stefan's law. With necessary theory explain an experiment to determine Stefan's constant

35. Distinguish between classical and quantum statistics. When do quantum statistics behaves as classical statistics. Distinguish between Fermi Dirac distribution and Bose Einstein distribution.

(2 × 15 = 30 Marks)
