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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, May 2019

First Degree Programme under CBCSS

Complementary Course

PY 1231.1 – THERMAL PHYSICS AND STATISTICAL MECHANICS

(For Mathematics)

(2018 Admission)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions. Answer should not exceed two sentences. Each question carries 1 mark.

1. Define the term macro state with the help of an example.
2. Explain phase space of a system.
3. State Rayleigh-Jeans law.
4. Explain the term thermodynamic probability.
5. State Kelvin statement of second law of thermodynamic.
6. Give the Planck's quantum postulates.
7. Why does the temperature of a gas decrease, When it is expanded adiabatically?

P.T.O.

8. Explain the term isentropic of curves of constant entropy.

9. Define the term entropy.

10. Explain the term Isothermal process.

(10 × 1 = 10 Marks)

PART – B

Answer **any eight** questions. Answer should not exceed one small paragraph. Each question carries **2** marks.

11. Distinguish between canonical and grand canonical ensemble.

12. Obtain an expression for the change in entropy when ice changes in to steam.

13. Deduce the expression for work done during adiabatic processes.

14. Mention the effective ways to increase Carnot's engine efficiency.

15. Define coefficient of thermal conductivity. What are its dimensions?

16. Explain the temperature dependence of a black body radiation.

17. Derive the equation for isothermal Elasticity.

18. State Wiedemann-Franz law.

19. Show that the slope of an adiabatic is γ times the slope of the isothermal.

20. Show that entropy remains constant in a reversible process.

21. Explain the concept of entropy and disorder.

22. Define the term efficiency of a heat engine.

(8 × 2 = 16 Marks)

PART – C

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

23. A bar of length 30 cm and uniform area of cross section 5 cm^2 consists of two halves AB of copper and BC of iron welded together at B. The end A is maintained at 200°C and the end C at 0°C. The side's of the bar are thermally insulate. Find the rate of flow of heat along the bar when the steady state is reached. Thermal conductivity of copper is 0.9 and thermal conductivity of iron is 0.12 CGS units.

24. Air at N.T. P is compresses adiabatically to half its volume. Calculate the change in its temperature.

25. A card is drawn from a well shuffled pack of 52 cards. Calculate the probability for this card to be either a king or a queen. There are 4 kings and 4 queens in a set of cards.

26. One gram molecule of a gas expands isothermally to four times of its volume. Calculate the change in its entropy in terms of the gas constant.

27. Calculate the work done when a gram molecule of an ideal gas expands isothermally at 50°C to double its original volume. Given R = 8.3 J/deg mole.

28. Calculate the surface temperature of sun and moon if the wavelength corresponding of the maximum intensity of radiations from them are 4753Å and 14 μ_m respectively. (Wien's constant b = .2898 centimeter kelvin).

29. The opposite faces of a meal 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 quantity of heat that will flow through the plate in one minute if, $K = 0.2$ CGS units.

30. Calculate the work done when one litre of a mono atomic perfect gas at N.T.P is compressed adiabatically to half its volume, $\gamma = 1.67$.

31. Calculate the change in entropy when 10 kg of water at 150°C is converted into steam at the same temperature. Given Latent heat of steam = 540 cal/gram.

(6 × 4 = 24 Marks)

PART – D

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

32. Describe with necessary theory, the construction and working of a diesel engine. Deduce the efficiency of a diesel engine in terms of the temperature between which it works.

33. State and derive Maxwell-Boltzmann distribution law and hence show that $n(E)dE = \frac{2N}{\sqrt{\pi}}\left(\frac{1}{KT}\right)^{3/2} E^{1/2} e^{-E/KT}.dE$. When $n(E)dE$ is the number of molecules with energies E and $E + dE$.

34. With necessary theory explain how thermal conductivity of a bad conductor is determined by Lee's disc method.

35. (a) Discuss the distribution of energy in the spectrum of black body on the basis of the spectrum obtained in the experiment performed by Lummer and Pringsheim.

    (b) Deduce Wien's displacement law for the distribution of energy in black body spectrum.

(2 × 15 = 30 Marks)