M – 2368

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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

First Degree Programme Under CBCSS

Physics

Complementary Course for Chemistry

PY 1231. 2 – THERMAL PHYSICS

(2020 Admission – Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions, each carries **1** mark.

1. State Fick's law.
2. Define the term coefficient of diffusivity.
3. Define thermal conductivity of a solid.
4. State Weidman Franz law.
5. Write Planck's equation for quantization of energy.
6. What is a blackbody?
7. Define isothermal process.
8. What is a heat engine?
9. Define entropy.
10. Define heat death of the Universe.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions, each carries **2** marks.

11. Explain Grahams law of Diffusions in liquids.
12. Explain a method for the coefficient of diffusivity.
13. Explain Wien's displacement law.
14. Explain Stefan's law.
15. What is emissivity of a body? What its value for a perfect blackbody?
16. Define solar constants.
17. Explain Kirchhoff's law of heat radiation.
18. Define an adiabatic process.
19. Which are the parts of a Carnot's engine? Draw a neat diagrams.
20. Carnot's engine is the most efficient Heat engine. Explain?
21. Explain adiabatic elasticity.
22. Which is more efficient? Petrol engine of Diesel engine. Why?
23. Explain the principle of increase of entropy.
24. What is the value of change in entropy of a reversible process?
25. What is TS diagram?
26. Define second law of thermodynamics in terms of entropy.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions each, carries **4** marks.

27. Derive the dimension of coefficient of diffusion of a fluid.

28. The thermal conductivity of copper at 200K is 413 W $m^{-1}K^{-1}$ and its electrical conductivity at this temperature is 84.6×10^6 seimens/m. Calculate the value of Lorentz number.

29. One end of a copper rod is maintained at 673K and its other end is kept at ice. The rod is perfectly insulated. Find the thermal energy radiated per minute. Given that the thermal conductivity of copper is 385 W $m^{-1}K^{-1}$. The length of the copper rod is 1.5 m and its area of cross section is $2.5 \times 10^{-4} m^2$.

30. In a nuclear reaction the maximum temperature obtained is 10^8 K. Calculate the wavelength of maximum energy. Wien' s constant $W = 2.898 \times 10^{-3} mK$.

31. A blackbody at 300K is radiates energy at the rate of 460 Wm^{-2}. Calculate the value of energy radiated by its at 400 K.

32. Derive the expression for work done in an isothermal process.

33. Prove that the work done in an adiabatic change is equal to its change in internal energy.

34. Calculate the efficiency of a petrol engine when it is used a fuel of adiabatic compression ratio $\rho = \frac{V_1}{V_2} = 5$. Given that $\gamma = \frac{C_v}{C_p} = 1.4$.

35. A Carnot's engine is working between 300K and 600K changes to its operating temperature to 300 K and 900 K. Calculate the improvement of efficiency by this change.

36. A Carnot's engine whose source is at 227°C takes a heat of 4200 J in each cycle and give out 3000 J heat to the sink. Find the temperature of the condenser (sink).

37. Draw and explain the TS diagram for a Carnot's cycle.

38. Calculate the entropy change when 1kg of water at 100°C is converted to steam at the same temperature. Given that the latent heat of vaporization is $2.168 \times 10^6 J\ kg^{-1}$.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions, each carries **15** marks.

39. Explain the analogy between liquid diffusion and heat conduction. Explain the methods of estimating concentration of a solution.

40. With necessary theory and description of experimental arrangement, explain the method of determination of thermal conductivity of a bad conductor using Lees disc method.

41. Derive the equation of work done in an isothermal process.

42. Derive the Rayleigh-Jean's law and the correction of Rayleigh law by Plank's distribution law.

43. Write the principle and working of a Diesel engine and derive the expression for its efficiency.

44. Explain change in entropy in reversible and irreversible cycles. What is the change in entropy when ice is converted to stream?

(2 × 15 = 30 Marks)