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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, August 2024

First Degree Programme under CBCSS

Physics

Core Course

PY 1241 : HEAT AND THERMODYNAMICS

(2018 – 2022 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in a word or sentence, Each question carries **1** mark.

1. State Stefan's law.
2. What is an adiabatic process.
3. Distinguish between isobaric and isochoric process.
4. Define solar constant.
5. What are the essential parts of a Carnot's engine?
6. State the principle of increase of entropy.
7. Give one example each for isothermal and adiabatic process.
8. Define entropy. Write its unit.

9. Give two examples for first order phase transition.

10. Write down the Clausius-Clapeyron equation and explain the symbols.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions in **two** or **three** sentences. Each question carries **2** marks.

11. Obtain the relation for work done in an isothermal process.

12. Distinguish between first order and second order phase transition.

13. Show that adiabatic curve is steeper than isothermal curve.

14. Explain how temperature of the sun can be calculated from Solar constant.

15. Discuss the theory of radial flow of heat.

16. How is entropy related to available energy.

17. Discuss about the latent heat on the basis of first law of thermodynamics.

18. What are the conditions for a system to be in thermodynamic equilibrium.

19. Draw the indicator diagram of diesel engine.

20. Briefly explain Clausius inequality.

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

22. What is a quasistatic process.

(8 × 2 = 16 Marks)

SECTION – C

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

23. A cubical ice box of side 30 cm has a thickness of 5cm. If 4 kg of ice is put in the box, estimate the amount of ice remaining after 6 hours. Outside temperature is 45°C. The thermal conductivity of the material of the box = $0.01 Wm^{-1}k^{-1}$ Latent heat of fusion of ice L = 335×10^3 J Kg^{-1}

24. Two stars A and B emit radiators of maximum wavelength 300nm and 400nm respectively. Find the ratio of the temperatures.

25. A quantity of dry air at 27° C is compressed adiabatically to half is volume. Calculate the change in its temperature $(\gamma = 1.4)$

26. A company claims to have developed an engine working between 227° C and 15° C having an efficiency 45%. Comment on this claim.

27. One mole of a gas at 27° C expands adiabatically until its volume is doubled. Calculate the work done.

28. Calculate the change in entropy when 10 grams of ice at 0° C is converted into water at the same temperature. Given Latent heat of ice is 336000 J/Kg

29. Calculate the change in entropy when 0.5 Kg of water at 40° C is mixed with 1Kg of water at 70° C. Specific capacity of water = 4180 J/Kg/ K

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

31. If the wavelength of maximum energy in the solar spectrum is 475 nm, calculate the effective temperature of the sun. Wien's constant = 2.898×10^{-3} mK

(6 × 4 = 24 Marks)

SECTION – D

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

32. Describe the working of a Carnot's engine. Derive an expression for its efficiency.

33. Describe an experiment to study the spectral distribution of black body radiation, Briefly discuss the attempts made by Wein, Rayleigh - Jean and Planck to explain the experimental results.

34. Define entropy. What is its physical significance? Show that entropy of a perfect gas remains constant in a reversible process and increases in an irreversible process.

35. For an adiabatic process, prove that PV = constant. Calculate the work done in an adiabatic process.

(2 × 15 = 30 Marks)