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Reg. No. : .....

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Second Semester B.Sc. Degree Examination, December 2021.

First Degree Programme under CBCSS

Physics

Complementary Course for Chemistry

PY 1231.2 – THERMAL PHYSICS

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

PART – A

Very Short answer type (Answer in one or two sentences)

Answer **all** questions. Each question carries **1** mark.

1. What is diffusion?
2. When can we say that the radiation is isotropic?
3. Why does Lampblack be considered to be a black body?
4. On what factors does the radiant emittance of a non-black body depend?
5. Explain the significance of temperature gradient.
6. How do you represent a reversible and irreversible process in an indicator diagram?
7. What is a working substance?
8. What is an extensive variable?

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9. The work done on a gas during an adiabatic process is 1000J. Find the change of its internal energy.

10. What are the limitations of the first law of thermodynamics?

(10 × 1 = 10 Marks)

PART – B

Short answer type (Answer in one paragraph)

Answer **any eight** questions. Each question carries **2** marks

11. What are the characteristics of diffusion?

12. What is thermal diffusivity? Explain the significance.

13. Thermal radiations are identical with light. Justify the statement.

14. Distinguish between Otto cycle and Diesel cycle.

15. Prove that for the whole system on which the Carnot engine operates, the algebraic sum of the entropy changes for the whole cycle is zero.

16. Explain why adiabatic expansion causes cooling.

17. What is internal energy? How does it arise?

18. What is a heat engine?

19. What is Graham's law of diffusion in liquids?

20. Define a system and its surroundings.

21. Is the temperature of an isolated system conserved? Explain.

22. What is coefficient of thermal conductivity? Give its dimension and unit.

(8 × 2 = 16 Marks)

PART – C

Short essay

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

23. Derive the expression for Fick's law in the form of a differential equation.

24. Calculate the change in entropy when 1kg of ice at 0°C is converted to steam at 100°C. Given latent heat of fusion of ice = $3.3472 \times 10^5 Jkg^{-1}$, the specific heat capacity of water $4184 Jkg^{-1}$, latent heat of vapourisation of water = $2.259 \times 10^6\ Jkg^{-1}$.

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25. Calculate the solar temperature from the following data. Stefan's constant = $5.67 \times 10^{-8} Wm^{-2}K^{-4}$, Solar constant = $1388 Wm^{-2}$, Radius of the sun = 7×10^{8}m, Distance between sun and earth = 1.5×10^{11}m.

26. Show that Wien's law and Rayleigh Jeans law can be attained from Planck's law.

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

28. Air at 27°C is suddenly expanded to 2 times of its original volume. Find the resulting change in temperature. For air $\gamma = 1.4$.

29. Two large closely spaced concentric black body radiators are maintained at 27°C and 100°C respectively. The space in between the two spheres is evacuated. Calculate the net rate of energy transfer between the two spheres. Stefan's constant = $5.67 \times 10^{-8} Wm^{-2}K^{-4}$.

30. A Carnot's engine is working between steam point and ice point. How much should be the temperature of the source must be raised to obtain an efficiency of 30%?

31. For a Diesel engine the adiabatic compression ratio is 20 and the combustion expansion ratio is 5. Find the efficiency of the engine if $\gamma = 1.4$.

(6 × 4 = 24 Marks)

PART – D

Essay

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

32. Explain the working of a Carnot's engine and find the expression for the efficiency.

33. Discuss the Lee's disc method for finding the conductivity of bad conductors.

34. Obtain Planck's radiation law from Planck's postulates.

35. Explain the features of isothermal and adiabatic processes? Find out the work done in adiabatic and isothermal processes.

(2 × 15 = 30 Marks)

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