

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme Under CBCSS

Physics

Complementary Course for Home Science

PY 1231.5 : THERMAL PHYSICS

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Very short answer: Answer **all** questions. **Each** carries **1** mark.

1. Brick walls are used in furnace of a boiler. Why?
2. What is meant by absorptive power?
3. Define coefficient of thermal conductivity.
4. Write down the Kelvin statement of second law of thermodynamics.
5. What is a reversible thermodynamic process?
6. Which heat engine is maximum efficient? Why?
7. Define solar constant.
8. What is the principle of increase of entropy?

9. State second law of thermodynamics in terms of entropy.
10. What is the unit of entropy?

(10 × 1 = 10 Marks)

### SECTION – B

Short Answer: Answer **any eight** questions. **Each** carries **2** marks.

11. State and explain Wien's displacement law.
12. Explain the limitation of Rayleigh Jean's law in explaining black body spectrum.
13. How do we calculate effective temperature of sun from solar constant?
14. Explain four different strokes of a petrol engine.
15. Draw the PV diagram of a diesel engine.
16. Distinguish between isothermal elasticity and adiabatic elasticity.
17. State Weidmann and Franz law. Write down its equation.
18. Explain Graham's law of diffusion.
19. State and explain Fick's law of diffusion.
20. Compare the efficiencies of petrol engine and diesel engine.
21. Write a short note on entropy and available energy.
22. Compare PV diagram and TS diagram of a Carnot's engine.
23. Explain first order phase transition with a suitable example.
24. Write down the comparison between liquid diffusion and heat conduction.
25. State and explain Stefan's law.
26. What is meant by super fluidity?

(8 × 2 = 16 Marks)

## SECTION – C

Answer any six questions. Each question carries 4 marks.

27. The wavelength of solar radiation for which the energy is maximum is 490nm. Calculate the surface temperature of sun. (Wien's constant = 0.2892 cmK).
28. Calculate the radiant emittance of a black body at temperatures 400K and 4000K.
29. Calculate the rate of loss of heat through a glass window of area 1000cm<sup>2</sup> and thickness 0.4cm when temperature inside is 37°C and outside is -5°C. Coefficient of thermal conductivity of glass is 0.0022cals<sup>-1</sup>cm<sup>-1</sup>k<sup>-1</sup>.
30. An engine has been designed to work between source and sink temperatures 177°C and 27°C respectively. If the energy input is 3600J, what is the work done by the engine?
31. Calculate the fall in temperature of helium initially at 15°C, when it is suddenly expanded to 8 times its volume if  $\gamma = 5/3$ .
32. Two moles of an ideal gas kept at a constant temperature of 300K are expanded from volume of 2 litre to 4 litre. Calculate the work done in the process (given  $R=8.31 \text{ Jmol}^{-1} \text{ k}^{-1}$ ).
33. Calculate the change in entropy when 0.0273 kg of ice at 0°C is converted into water at the same temperature (Latent heat of fusion of water is  $3.34 \times 10^5 \text{ J/K}$ ).
34. One gram molecule of gas expands isothermally to four times its volume. Calculate the change in entropy in terms of gas constant.
35. When 50g of water is heated from 10°C to 90°C, by how much does its entropy change? (specific heat of water = 4200 J/kg°C)
36. Two large closely spaced concentric spheres (both are black body radiators) are maintained at temperatures of 200K and 300K respectively. The space between the spheres is evacuated. Calculate the net rate of energy transfer between the two spheres. (Given  $\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$ )

37. Two metal cubes A and B of same size are in contact. The ratio of coefficient of thermal conductivities of A and B is 1.5. The extreme end of A is at a temperature  $100^{\circ}\text{C}$  and that of B is at a temperature of  $0^{\circ}\text{C}$ . Calculate the temperature of the interface after steady state is reached.
38. The spectral energy distribution of the sun has a maximum at  $475.3\text{nm}$ . If the temperature of the sun is  $6050\text{K}$ , what is the temperature of a star for which maximum emission is at  $950.6\text{nm}$ .

(6 × 4 = 24 Marks)

#### SECTION – D

Answer any two questions. Each question carries 15 marks.

39. What is meant by black body spectrum? What are the results obtained from black body spectrum? How did Planck explain the black body spectrum?
40. Explain the working of a Carnot's engine. Derive the expression for efficiency of a Carnot engine.
41. Obtain the expressions for work done in isothermal and adiabatic processes.
42. Explain change in entropy in reversible and irreversible cycles. What is the change in entropy when ice is converted to steam?
43. Explain different methods of estimating concentrations. Explain the method of determination of coefficient of diffusivity.
44. Explain the principle and experimental details of Lee's method of determining thermal conductivity.

(2 × 15 = 30 Marks)