

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023**(Supplementary - 2018 admission)****PHYSICS: COMPLEMENTARY COURSE FOR MATHEMATICS & CHEMISTRY****APHY1C01T: PROPERTIES OF MATTER & THERMODYNAMICS****Time: 3 Hours****Maximum Marks: 64****SECTION A: Answer *all* the questions. Each carries *one* mark.**

1. Explain elasticity.
2. What is viscosity?
3. What is meant by isobaric process?
4. Write the mathematical expression for first law of thermodynamics.
5. What is entropy?
6. Draw the P-V diagram.
7. In Carnot cycle, the last two steps are:
8. Gibbs potential is defined as:
9. What happens to the entropy in natural process?

(9 x 1 = 9 Marks)**SECTION B: Answer any *seven* questions. Each carries *three* marks.**

10. Derive the expression for the couple required to twist a cylinder through an angle θ .
11. What are I section girders? What are their advantages?
12. Derive an expression for the bending moment of a beam.
13. Derive an expression for excess pressure inside a drop of radius r .
14. Write a short note on Brownian motion.
15. Show that the entropy change in a Carnot's cycle is zero.
16. Obtain the relation between volume and temperature of gas undergoing adiabatic process.
Use the relation $PV^\gamma = k$
17. Discuss the working principal of a Carnot's refrigerator.
18. Write notes on: a) Principle of increase of energy. b) Entropy and unavailable energy.
19. Write short notes on a) internal energy, b) Quasi-static process, c) external and internal work.

(7 x 3 = 21 Marks)**(PTO)**

SECTION C: Answer any six questions. Each carries three marks.

20. A rod of rectangular cross section having breadth 3 cm and thickness 2 cm is bent in the form of arc of radius 10 m. If the Young's modulus is 10^{10} N/m², find stress, strain and bending moment.
21. The modulus of rigidity and Poisson's ratio of the material of a wire are 4.87×10^{10} N/m² and 0.479 respectively. Find the Young's modulus of the material of the wire.
22. A cantilever of length 1 m has a depression of 10 mm at its free end. Calculate the depression at a distance of 0.4 m from the fixed end.
23. A soap bubble has a radius of 2 cm. If the surface tension of soap solution is 0.03 N/m, calculate the pressure inside the bubble.
24. Using Poiseuille's law, calculate the flow rate of a liquid through a cylindrical pipe of radius 0.02 m and length 5 m. The pressure difference is 200 Pa, and the viscosity of the liquid is 0.0015 Pa.s.
25. A Carnot's engine working between a source at 400 K and a sink at T_2 K has an efficiency of 50%. If the temperature of both the source and the sink are increased by 100 K, what is the efficiency of the engine?
26. Find the work done to stretch a copper wire 1 m long and 2 mm in diameter through 1 cm. (Given $= 12.5 \times 10^{10}$ N/m²)
27. Initial pressure of an ideal gas at 30⁰ C is 'p'. Calculate the rise in temperature at which the pressure suddenly increases to 10 times its original pressure. (Given $\gamma = 1.4$).
28. Find the change in entropy when 1 gm. of ice at 0⁰ C changes to water at 10⁰ C.

(6 x 3 = 18 Marks)

SECTION D: Answer any two questions. Each carries eight marks.

29. Define a cantilever? Describe an experimental method for determining the Young's modulus of a material of cantilever.
30. Discuss the factors that affect surface tension and explain how they influence the phenomenon.
31. State and explain Kelvin-Planck and Clausius statements of second law of thermodynamics. Show that they are equivalent.
32. State and prove Carnot's theorem and its corollary. Derive the expression for efficiency of Carnot's engine.

(2 x 8 = 16 Marks)