



K25U 2360

Reg. No. :

Name :

V Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/
Improvement) Examination, November 2025
(2019 to 2023 Admissions)
CORE COURSE IN PHYSICS
5B08PHY : Thermodynamics and Statistical Mechanics

Time : 3 Hours

Max. Marks : 40

SECTION – A

(Short answer questions. Answer **all** questions. **Each** question carries **1** mark.)

1. What is a hydrostatic system ?
2. State the Kelvin-Planck statement of the second law of thermodynamics.
3. Why is entropy regarded as a measure of disorder ?
4. What is the Joule-Thomson effect ?
5. What is meant by statistical distribution of particles and why is it important in modern physics ?
6. Why Dulong-Petit law fails at low temperatures ?

(6×1=6)

SECTION – B

(Short essay questions. Answer **any six** questions. **Each** carries **2** marks.)

7. Explain the Zeroth law of thermodynamics and its importance.
8. How is temperature defined in thermodynamics ?

P.T.O.

K25U 2360

-2-



9. What are the conditions for thermodynamic equilibrium ?
10. Derive the expression for work done in a reversible adiabatic process.
11. How does the diesel engine differ from the Otto engine ?
12. What are thermodynamic potentials and why are they important ?
13. Draw the phase diagram of water in terms of pressure and temperature.
14. Describe Einstein's theory of specific heat of solids.

(6×2=12)

SECTION – C

(Problems. Answer **any four** questions. **Each** carries **3** marks.)

15. In a petrol engine, (internal combustion engine) air at atmospheric pressure and temperature of 20°C is compressed in the cylinder by the piston to 1/8 of its original volume. Calculate the temperature of the compressed air. (For air $\gamma = 1.4$)
16. Calculate the efficiency of an engine that absorb heat at 600 K and exhaust it at 400 K.
17. Calculate the work done when one-gram molecule of an ideal gas expands isothermally at 27°C to double its original volume. Given $R = 8.3 \text{ JK}^{-1} \text{ mole}^{-1}$, Given $T = 27^\circ\text{C} = 300 \text{ K}$, $V_2 = 2 V_1$, $R = 8.3 \text{ JK}^{-1} \text{ mole}^{-1}$.
18. Calculate the change in the boiling point of water due to the difference of 1 Torr pressure [$L = 540 \text{ cal/g}$ and specific volume of steam = $1760 \text{ cm}^3/\text{g}$].
19. A container holds one mole of helium gas at a temperature 293 K. Calculate the mean energy of the molecules. How many molecules have energies in an interval of 0.01 times mean energy centred on mean energy ?
20. What pressure must be applied to nitrogen gas at room temperature before Maxwell Boltzmann statistics begins to fail ?

(4×3=12)



-3-

K25U 2360

SECTION – D

(Long Essay. Answer **any two** questions. **Each** carries **5** marks.)

21. State and explain the first law of thermodynamics. Derive its mathematical formulation for a closed system.
22. Define a quasistatic adiabatic process. Derive the relation $pV^\gamma = \text{constant}$.
23. Explain the working of a Carnot engine. Derive its efficiency in terms of the temperatures of the reservoirs.
24. Draw a T-S diagram for an ideal gas and explain its significance in thermodynamics.

(2×5=10)