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END SEMESTER EXAMINATION – MAY 2025
PHYSICS – II SEMESTER BSC
24BSC24B - KINETIC THEORY OF GASES, HEAT AND THERMODYNAMICS

Time: 3 Hours **Max. Marks: 80**

Instruction: *Answer should be written completely in English*

SECTION – A

Answer any **TEN** questions. Each question carries **TWO** marks. **(10X2=20)**

1. What is meant by mean free path?
2. State the principle of equipartition of energy.
3. Define the entropy of a thermodynamic system.
4. Distinguish between intensive and extensive properties.
5. Define the triple point of water.
6. Write the Clausius-Clapeyron equation and define its terms.
7. Briefly explain the Joule-Thomson effect.
8. What is a black body?
9. Briefly discuss the concept of Ultraviolet catastrophe.
10. State Wien's displacement law.
11. Distinguish between natural convection and forced convection.
12. Distinguish between the absorptive power and emissive power of a body.

SECTION – B

Answer any **FOUR** questions. Each question carries **FIVE** marks. **(4X5=20)**

13. Calculate the pressure exerted by hydrogen if the density of hydrogen is 0.1 kg m^{-3} and the rms speed of hydrogen molecules at that pressure is 2 km s^{-1}.
14. A 1.0 mol sample of an ideal gas is kept at 0 °C during an expansion from 3 L to 10 L. (a) How much work is done by the gas during the expansion? (b) How much energy is transferred as heat to or from the surroundings in this process?
    [Data: $\boldsymbol{R}$ = 8.31 J mol^{-1} K^{-1}].
15. One litre of air at NTP is suddenly compressed to 1 cc. What will be the final pressure? (Given $\gamma = 5/3$, 1 cc = 10^{-3} litre).
16. Determine the change in entropy of 1 kg of water heated from 10 °C to 95 °C at atmospheric pressure on a stove. [Data: C_p = 4200 J kg^{-1} K^{-1}].

17. Calculate the change in the melting point of ice when it is subjected to a pressure of 50 atmospheres. The density of ice = 917 kg m^{-3}, and the latent heat of ice = 336 x 1000 J kg^{-1}.
18. If the temperature of a blackbody is increased from 100°C to 400°C, by what factor does the rate of emission increase?

SECTION – C

Answer any **FOUR** questions. Each question carries **TEN** marks. **(4X10=40)**

19. Answer the following questions briefly:
    (a) State the assumptions of the kinetic theory of gases.
    (b) Distinguish between average speed, most probable speed, and root mean square speed.
    (c) Distinguish between C_P and C_V and state the relation between them.
20. Define thermal conductivity in gases. Derive the expression for the coefficient of thermal conductivity of gases.
21. Describe the processes involved in the Otto cycle with the help of a PV diagram.
22. Derive the first and second TdS equations.
23. Discuss the effect of change in pressure on the boiling point of water and the melting point of ice. Given, normal boiling point of water = 100 °C, normal melting point of ice = 0 °C, normal latent heat of vaporization = 540 x 4200 J, latent heat of melting = 80 x 4200 J, specific volume of water = 1 m^3, specific volume of steam = 2.676 m^3, specific volume of ice = 1.091 m^3, and change in pressure = 1 atm = 1.015 x 10^5 N m^{-2}.
24. (a) Explain the significance of the solar constant in the context of solar radiation received by Earth.
    (b) Using the concept of blackbody radiation, develop a method to estimate the surface temperature of the Sun.
    (c) Then, using the following data, calculate the solar constant and the surface temperature of the Sun: $\sigma = 5.67 \times 10^{-8}$ W.m^{-2}.K^{-4}, S=1.388 x 10^3 W.m^{-2}, R = 6.928 x 10^8 m, r = 1.5 x 10^{11} m.