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Reg. No. :

Code No. : 30453 E Sub. Code : CMPH 41

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2024

Fourth Semester

Physics — Core

HEAT AND THERMODYNAMICS

(For those who joined in July 2021 and 2022 only)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The minimum temperature produced using adiabatic demagnetization is
(a) 1 K (b) 10^{-3} K
(c) 10^{-4} K (d) 10^{-5} K
2. The lowest pressure lambda point at 2.172 K is
(a) 0.0497 atm (b) 0.003 atm
(c) 0.0457 atm (d) 0.0476 atm

3. Viscosity of a gas is due to transport of

(a) Momentum (b) Energy
(c) Force (d) None

4. Van Der Waals equation is

(a) $\left(P + \frac{a}{V^2}\right)(V - b) = RT$
(b) $\left(P + \frac{a}{V^2}\right)(V + b) = RT$
(c) $\left(P - \frac{a}{V^2}\right)(V - b) = RT$
(d) $\left(P - \frac{a}{V^2}\right)(V + b) = RT$

5. Which gas has the highest thermal conductivity at the same temperature?

(a) Oxygen (b) Hydrogen
(c) Helium (d) Carbon dioxide

6. A black body is an idealized physical body that _____ all incident electromagnetic radiation.

(a) absorbs (b) emit
(c) reflect (d) conduct

7. First law of thermodynamics also known as the law of conservation of _____.

- (a) energy
- (b) momentum
- (c) mass
- (d) density

8. The efficiency of the Carnot's engine $\eta =$ _____.

- (a) $1 - \frac{T_2}{T_1}$
- (b) $1 - \frac{T_1}{T_2}$
- (c) $\frac{T_2}{T_1}$
- (d) $\frac{T_1}{T_2}$

9. From Maxwell's thermodynamic relations, $\frac{E_S}{E_T} =$ _____.

- (a) 2
- (b) $\frac{1}{Y}$
- (c) Y
- (d) None

10. The boiling point of a substance increases when the pressure is

- (a) increased
- (b) decreased
- (c) constant
- (d) none

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PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) State and explain Joule's Kelvin Effect.

Or

(b) Explain the liquefaction of Hydrogen.

12. (a) Explain about kinetic theory of gas.

Or

(b) State and determine Vander Walls Constant.

13. (a) State and explain thermal conductivity.

Or

(b) Describe about black body radiation.

14. (a) State and explain the First Law of Thermodynamics.

Or

(b) Distinguish between isothermal and adiabatic processes.

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15. (a) State and explain third law of thermodynamics.

Or

- (b) Explain the Temperature - Entropy diagram.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 600 words.

16. (a) What are liquid Helium I and II? Discuss the important properties of liquid Helium II.

Or

- (b) Explain the working of a refrigerator.

17. (a) Derive the expression for the thermal conductivity of a gas on the basis of kinetic theory of gases.

Or

- (b) Derive the Vander Waals equation of a state.

18. (a) Give the detail explanation of thermal conductivity of good conductor.

Or

- (b) Explain construction and working of Lee's disc method with suitable diagram.

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19. (a) Discuss with necessary theory, the construction and working of Otto engine.

Or

- (b) Discuss with necessary theory, the construction and working of Diesel Engine.

20. (a) State and derive the Clausius-Clapeyron first latent heat equation.

Or

- (b) Deduce the Maxwell's Thermodynamical relations.

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