



**2021/TDC/CBCS/ODD/
PHSHCC-302T/151**

**TDC (CBCS) Odd Semester Exam., 2021
held in March, 2022**

PHYSICS

(3rd Semester)

Course No. : PSHCC-302T

(Thermal Physics)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

Answer any *ten* of the following questions :

$2 \times 10 = 20$

1. What are reversible and irreversible processes?
2. Explain why gases have two specific heats while solids have only one.
3. Distinguish between isothermal and adiabatic processes.



(2)

4. Narrate the third law of thermodynamics.
5. Explain in brief the concept of 'heat death of the Universe'.
6. State the significance of thermodynamic potential.
7. What do you mean by Joule-Kelvin coefficient for an ideal gas?
8. Discuss in brief the change of temperature during adiabatic process.
9. Define phase transition. What is first order phase transition?
10. Define free path and mean free path.
11. State the law of equipartition of energy.
12. What is the effect of temperature and pressure on thermal conductivity?
13. State the law of corresponding states.
14. What is temperature of inversion?
15. In what way a real gas differs from an ideal gas?

22J/689

(Continued)

(3)

SECTION—B

Answer any five of the following questions : $6 \times 5 = 30$

16. (a) Show that for one mole of an ideal gas $C_p - C_v = R$ (symbols have their usual meanings). 3
(b) A Carnot engine has an efficiency of 30% when the temperature of the sink is 27°C . What must be the change in temperature of the source to make its efficiency 50%? 3
17. (a) State the first law of thermodynamics. Explain how first law of thermodynamics leads to the concept of internal energy. 1+2=3
(b) Write the second law of thermodynamics as stated by Kelvin-Planck and Clausius, and discuss their equivalence. 3
18. (a) Show that the entropy of a perfect gas remains constant in a reversible process. 3
(b) State and explain the temperature-entropy diagram for Carnot's cycle. 3
19. (a) Prove that for a complete reversible cycle, change in the state of substance $\oint dS = 0$. 3

22J/689

(Turn Over)



(4)

- (b) Define the following : 3
- (i) Enthalpy
 - (ii) Helmholtz free energy
 - (iii) Gibbs' free energy
20. (a) Derive the Clausius-Clapeyron equation. 3
- (b) From the consideration of Maxwell's thermodynamic relations, show that $C_p - C_v = R$ (here symbols have their usual meanings). 3
21. (a) Deduce Maxwell's first thermodynamic relation using the laws of thermodynamics. 3
- (b) Explain how the boiling point of a liquid and melting point of a solid are affected with the change of pressure. 3
22. (a) Using Maxwell-Boltzmann distribution law of velocities, find an expression for the mean speed in an ideal gas. 3
- (b) What do you mean by Doppler broadening of spectral lines? 3
23. (a) Discuss in brief the Brownian motion and its significance. 3

22J/689

(Continued)

(5)

- (b) Derive the relation for coefficient of self-diffusion D and show that it is directly proportional to $T^{3/2}$. 3
24. (a) What is Joule-Thomson effect? How will you interpret the effect experimentally? 3
- (b) Discuss in brief Andrews experiment on CO_2 gas. 3
25. (a) Define critical coefficient of a gas. Is it same for all gases? Does experimental value agree with the theoretical value? 3
- (b) Define temperature of inversion. Derive the expression for the inversion temperature for van der Waals' gas
 $T_i = \frac{2a}{R_b}$ 3

22J/689

2021/TDC/CBCS/ODD/
PHSHCC-302T/151