

2023

B.Sc. (Honours)

B.Sc. Third Semester End Examination - 2023

PHYSICS

PAPER - CC6T

Full Marks : 40

Time : 2 hours

*The figures in the right-hand margin indicate marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

**Group - A**

1. Answer any five questions

5×2=10

- (a) For a gas under isothermal conditions, its pressure varies with volume as  $p \propto v^{-5/3}$ . Calculate the value of bulk modulus and degree of freedom.
- (b) Show that Maxwell's law of distribution of molecular speed is independent of temperature if the most probable speed is taken as the unit of measuring.

*(Turn Over)*

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- (c) The mean free path of the particles of gas at temperature  $T_0$  and pressure  $P_0$  has a value  $\lambda_0$ . If the pressure is increased to  $1.5 P_0$  and the temperature is reduced to  $0.75 T_0$ . Calculate the value of new mean free path.
- (d) Calculate the Van-der Waals' constants for dry air, given that  $T_c=132K$ ,  $P_c=37.2$  atoms, R per mole =

$$82.07 \frac{\text{cm}^3 - \text{atoms}}{\text{K}}$$

4. (a) What is Gibb's potential?  
(b) Show that the Enthalpy

$$H = \left[ \frac{\partial(G/T)}{\partial\left(\frac{1}{T}\right)} \right]_v$$

Where G is the Gibb's Enerty.

5. (a) Show that the number of molecules striking unit area of surface per unit time is  $\frac{\eta \bar{c}}{4}$ , where average speed is  $\bar{c}$  and  $\eta$  is the number of molecules per unit volume.
- (b) Define 'Boyle temperature' and 'critical temperature' of a gas. How they are related for a Van-der Waals gas?

2+3

( 3 )

6. (a) Show that for ideal gas pressure (p) is perfect differential.  
(b) Show that for one mole of Vander Waal's gas

$$d\Phi = CVdT + \frac{RT}{v-b} dv \quad 2+3$$

7. (a) Show that the root mean-square speed C is  $\sqrt{\frac{3}{\gamma}}$  times the speed of sound.  
(b) What is the importants of second viral co-efficient?

3+2

### Group - C

8. Answer any one question : 1×10=10
- (a) Distinguish between cooling produced by J-T expansion and adiabatic expansion.
- (b) Derive an expression for J-T co-efficient  $\mu$ .
- (c) Show that for a Van-der Waals gas

$$\mu = \frac{b}{C_p} \left( \frac{T_p}{T} - 1 \right)$$

Where  $T_i$  is inversion temperature. Hence write down the importance of inversion temperature. 2+3+4+1

( 4 )

9. (a) Derive 1st Tds n equation in thermodynamic system.
- (b) Show that entropy of the 'Universe' increases in an irreversible process.
- (c) Prove that  $C_p - C_v = T \left( \frac{\partial P}{\partial T} \right)_v \left( \frac{\partial V}{\partial T} \right)_p$
- (d) What is the importance of Clapeyron Equation in phase transition? 2+3+3+2