B.Sc. (Part I) Examination

PHYSICS

Paper—II

(Kinetic Theory and Thermodynamics)

Time—Three Hours]   [Maximum Marks—40

Note :— (1)   All questions are compulsory.

(2)   Draw neat diagrams wherever necessary.

EITHER

1.   (a)   What is an ideal gas ?   1

(b)   What are degrees of freedom ? Explain them
with reference to monoatomic, diatomic and poly
atomic gas molecules.   2

(c)   Give kinetic interpretation of temperature.   2

(d)   State and prove law of equipartition of energy.

3

OR

2.   (p)   Explain the nature of van der Waals' forces. 2

(q)   Show that $\gamma = \left(1 + \dfrac{2}{n}\right)$, where n is number of

degree of freedom.   2

(r)   Define critical constants and obtain their values.

4

EITHER

3.   (a)   What is Joule-Thomson effect ? Define Joule-
Thomson coefficient.   2

(b) Explain principles of :
(i) Cascade cooling
(ii) Regenerative cooling. 4

OR

(c) Draw well labelled diagram for liquefaction of Hydrogen. 2

4. (p) Define
(i) mean free path
(ii) collision cross section. 2
(q) Deduce an expression for coefficient of viscosity of a gas in terms of mean free path. 4
(r) Discuss the effect of pressure and temperature on the coefficient of viscosity. 2

EITHER

5. (a) State zero^th law of thermodynamics. 1
(b) Explain reversible and irreversible changes giving one example each. 3
(c) State and prove Carnot's theorem. 4

OR

6. (p) What is entropy ? Explain. 2
(q) Describe Kelvin's absolute scale of temperature. 3
(r) A Carnot's heat engine working between source and sink temperatures of 500° K and 300° K receives 1500 calories of heat per cycle. Calculate efficiency of engine. 3

EITHER

7. (a) Obtain Maxwell's general relationship connecting the thermodynamic variables. 4

(b) Derive the following thermodynamic relation :—
$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V .$$ 4

OR

8. (p) Derive the Maxwell's thermodynamic relation :
$$\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P .$$ 4
(q) Explain the application of Maxwell's thermodynamic relation to Adiabatic cooling. 4

EITHER

9. (a) Describe the temperature dependence of black body radiation. 3
(b) State and explain Rayleigh-Jeans law. 2
(c) What is ultraviolet catastrophe ? 2
(d) Define : Perfectly black body. 1

OR

10. (p) State and explain Wein's law of black body radiation. 2
(q) State and explain Planck's quantum hypothesis. 2
(r) Derive Planck's law of black body radiation. 4