

B.Sc. (Part-I) Semester-II Examination

2S : PHYSICS

Kinetic Theory, Thermodynamics and Electric Currents

Time : Three Hours]

[Maximum Marks : 80

Note :— (1) **ALL** questions are compulsory.

(2) Draw neat and well labelled diagrams wherever necessary.

1. (A) Fill in the blanks :

2

- (i) Mean free path of a gas molecule is _____ proportional to the density of gas.
- (ii) In isothermal process _____ remains constant.
- (iii) The pressure just necessary to liquify the gas at critical temperature is called as _____.
- (iv) Velocity of the particle coming out from velocity selector is _____.

(B) Choose the correct alternative :

2

(i) Cyclotron can accelerate :

- (a) Neutron
- (b) Proton
- (c) Electron
- (d) All particles

(ii) Current is a :

- (a) Scalar quantity
- (b) Vector quantity
- (c) Derived quantity
- (d) None of these

(iii) In porous plug experiment enthalpy (H) of the gas :

- (a) Increases
- (b) Slowly decreases
- (c) Remains constant
- (d) Rapidly decreases

(iv) Entropy is a measure of :

- (a) Perfect order
- (b) Disorder
- (c) Available energy
- (d) Pressure

(C) Answer in one sentence each :

4

- (i) What is j-operator ?
- (ii) What is mass spectrograph ?
- (iii) Define mean free path.
- (iv) Define current density.

EITHER

2. (A) State any four assumptions of Kinetic theory of Gases. 2
(B) Derive van der Waal's equation of state. 5
(C) Derive an expression for mean free path of a gas molecule in terms of density of a gas. 5

OR

3. (P) What are degrees of freedom ? Find degrees of freedom for monoatomic and diatomic gas. 5
(Q) Define :
(i) Critical pressure of a gas
(ii) Critical volume of a gas. 2
(R) State and prove law of equipartition of energy. 5

EITHER

4. (A) Deduce an expression for the efficiency of Carnot's heat engine. 6
(B) Derive an expression for the entropy of a perfect gas. 3
(C) State and explain first law of thermodynamics. 3

OR

5. (P) Find the change in entropy when 10 kg of ice at 0°C is converted into water at the same temperature, if the latent heat of fusion of ice is 80 Kcal/kg. 3
(Q) State and prove Carnot's theorem. 5
(R) Explain with one example :
(i) Reversible process
(ii) Irreversible process. 4

EITHER

6. (A) Derive Clausius-Clapeyron heat equation. 6
(B) Explain the method of the liquefaction of Helium. 6

OR

7. (P) What is Joule-Thomson effect ? Explain the Porous Plug experiment. 6
(Q) Derive the Maxwell's equation :

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

6

EITHER

8. (A) Explain the principle, construction and working of Cyclotron. 6
(B) What is velocity selector ? Explain its working. 4
(C) What is electron gun ? 2

OR

9. (P) Explain the principle, construction and working of linear accelerator. 6
(Q) Describe the motion of charged particle in a :
(i) Transverse electric field
(ii) Transverse magnetic field. 3+3

EITHER

10. (A) State and prove maximum power transfer theorem. 6
(B) Give the construction and theory of Ballistic Galvanometer. 6

OR

11. (P) State and explain superposition theorem. 6
(Q) Obtain an expression for decay of charge in C-R circuit when constant source of emf is removed from the circuit. 6

EITHER

12. (A) Explain parallel resonant circuit. Obtain its resonant frequency. 4
(B) Explain energy losses in the transformer. 4
(C) Explain the terms :
(i) R.M.S. value of alternating current
(ii) Average value of alternating current. 4

OR

13. (P) Explain the construction and theory of ideal transformer. 5
(Q) Using j-operator method, obtain an expression for the current and impedance of series L-C-R circuit when ac is applied. 6
(R) What is power factor ? 1

