B.Sc. (Part–I) Semester—II Examination

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 :

(i) Ballistic galvanometer measures the amount of _____.

(ii) Large Q value indicates the _____ resonance.

(iii) Joule–Thomson effect is an _____ process.

(iv) In an adiabatic change the entropy _____. 2

(B) Choose the correct alternative :

(i) The numbers of degree of freedom for diatomic gas are :

(a) 3 (b) 5

(c) 7 (d) 6

(ii) When a charged particle moves in a transverse magnetic field, it traces _____.

(a) Circular path (b) Straight path

(c) Parabolic path (d) Irregular path

(iii) Internal energy of an ideal gas depends upon _____.

(a) Pressure (b) Volume

(c) Temperature (d) Mass

(iv) According to Kirchhoff's Law where the algebraic sum of current is zero ?

(a) In a linear network (b) In a closed circuit

(c) At a junction (d) None of these 2

(C) Answer in one sentence :

(i) What is j-operator ?

(ii) What are the values of critical temperature of H_2 and O_2 gases ?

(iii) Define current density.

(iv) What is specific heat ? 4

EITHER

2. (A) State any four essential features of Brownian Motion. 2

(B) What are degrees of freedom ? Find degrees of freedom for monoatomic and diatomic molecules. 5

(C) Show that the average kinetic energy per mole per degree of freedom is ½ RT. 5

OR

3. (P) Show that average kinetic energy of gas molecules is directly proportional to its absolute temperature. 2

(Q) Derive Van der Waal's equation of State of real gas. 6

(R) Obtain an expression for mean free path of the molecule of gas. 4

EITHER

4. (A) State the first Law of thermodynamics. 2

(B) State and prove Carnot's Theorem. 6

(C) State second Law of thermodynamics in :

(i) Claussius form

(ii) Kelvin – Planck form. 4

OR

5. (P) Find the efficiency of Carnot's engine working between the steam point and the ice point. 2

(Q) What is P-V indicator diagram ? Explain the P-V indicator diagram for cyclic and non-cyclic process. 6

(R) Explain the terms :

(i) Reversible Process

(ii) Irreversible Process. 4

EITHER

6. (A) State the principle of regenerative cooling method. 2

(B) With the help of neat diagram, describe the method of liquefaction of hydrogen gas. 6

(C) Derive the thermodynamic relation :

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)V$$ 4

OR

7. (P) With the help of neat diagram, describe the method of liquefaction of helium gas. 6

   (Q) Describe the porous plug experiment and discuss its result. 6

EITHER

8. (A) Explain the motion of charged particle in a transverse electric field. 4

   (B) Explain the principle and working of Linear Accelerator. 6

   (C) An electron moving in uniform magnetic field (B) is 20×10^{-4} Wb/m^2 follows a circular path. If the orbital velocity is 4×10^7 m/s.

   Calculate the radius of orbit :

   $$\left[\text{Given}: \begin{matrix}\text{Mass of electron } m_e = 9.1\times10^{-31}\text{ kg} \\ \text{Charge on electron } (q) = 1.6\times10^{-19}\text{ c}\end{matrix}\right]$$ 2

OR

9. (P) Explain the principle, construction and working of Cyclotron. 6

   (Q) Explain the principle, construction and working of Bainbridge Mass Spectrograph. 6

EITHER

10. (A) State and explain Thevenin's theorem. 6

    (B) Obtain an expression for the growth of current LR circuit. 4

    (C) State Kirchhoff's Current Law. 2

OR

11. (P) State and prove Maximum Power Transfer Theorem. 6

    (Q) Enlist the physical quantities measured by galvanometer and ballistic galvanometer. 2

    (R) Obtain an expression for growth of charge in a CR circuit when connected to a constant source of emf. 4

EITHER

12. (A) What is series resonant circuit ? 2

    (B) Explain the principle, construction and working of a transformer. 5

    (C) Show that when an a.c. is applied to a pure inductor, the current lags behind the applied alternating voltage by $\pi/2$. 5

OR

13. (P) Define the Quality Factor. 2

    (Q) Derive an expression for the average power in an a.c. circuit. 4

    (R) Using j-operator method obtain an expression for the current and impedance in series C-R circuit when ac is applied to it. 6