BF—87—2016
FACULTY OF SCIENCE
B.Sc. (First Year) (Second Semester) EXAMINATION
OCTOBER/NOVEMBER, 2016
PHYSICS
Paper III
(Kinetic Theory, Heat and Thermodynamics)
(MCQ+Theory)

(Saturday, 22-10-2016)   **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours*   *Maximum Marks*—40

N.B. :— (i) Attempt *All* questions.

    (ii) Question No. **1** is MCQ type. Answer MCQs on OMR sheet only.

    (iii) Use separate answer-sheet for MCQ type questions and descriptive type questions.

    (iv) Question Nos. **2, 3** and **4** are descriptive type questions.

    (v) Time allotted for MCQ examination is 30 minutes and for descriptive examination is 1½ hours only.

    (vi) Negative marking system is applicable to MCQ examination.

(MCQ)

1. Attempt *all* multiple choice questions :   10

    (i) Thermal conductivity of a gas is due to transport of ....

      (a) Momentum   (b) Energy

      (c) Mass   (d) Entropy

    (ii) Diffusion is considered as the phenomenon of ....

      (a) Transport of mass   (b) Transport of energy

      (c) Both (a) and (b)   (d) None of these

P.T.O.

(*iii*) The Boyle temperature is given by :

(*a*) $T_B = \dfrac{2a}{Rb}$ (*b*) $T_B = \dfrac{a}{R^2 b}$

(*c*) $T_B = \dfrac{a}{Rb}$ (*d*) $T_B = \dfrac{2a^2}{Rb}$

(*iv*) At critical temperature, a gas can be liquefied by the increase in ....

(*a*) pressure alone

(*b*) volume alone

(*c*) both (*a*) and (*b*)

(*d*) none of the above

(*v*) The correction in pressure by van der Waals' is ....

(*a*) $p = \dfrac{2a}{V^2}$ (*b*) $p = \dfrac{a}{V}$

(*c*) $p = \dfrac{3a}{V}$ (*d*) $p = \dfrac{a}{V^2}$

(*vi*) The second law of thermodynamics in terms of entropy is ....

(*a*) $dQ = \dfrac{T}{dS}$ (*b*) $dQ = \dfrac{dS}{T}$

(*c*) $dQ = \dfrac{1}{T \cdot dS}$ (*d*) $dQ = T \cdot dS.$

(*vii*) The efficiency of Carnot's engine is ....

(*a*) $\eta = 1 + \dfrac{T_2}{T_1}$ (*b*) $\eta = 1 - \dfrac{T_2}{T_1}$

(*c*) $\eta = 1 + \dfrac{T_1}{T_2}$ (*d*) $\eta = 1 - \dfrac{T_1}{T_2}$

(viii) Entropy is maximum in which state ?

  (a) solid (b) liquid

  (c) gas (d) none of these

(ix) The Clausius-Clapeyron latent heat equation is :

  (a) $\dfrac{d\mathrm{P}}{d\mathrm{T}} = \dfrac{\mathrm{L}}{\mathrm{T}(\mathrm{V}_2 - \mathrm{V}_1)}$ (b) $\dfrac{d\mathrm{P}}{d\mathrm{T}} = \dfrac{\mathrm{L}^2}{\mathrm{T}(\mathrm{V}_2 - \mathrm{V}_1)}$

  (c) $\dfrac{d\mathrm{P}}{d\mathrm{T}} = \dfrac{\mathrm{L}}{\mathrm{T}^2(\mathrm{V}_2 - \mathrm{V}_1)}$ (d) $\dfrac{d\mathrm{P}}{d\mathrm{T}} = \dfrac{\mathrm{L}}{\mathrm{T}^2}$

(x) Helmholtz free energy function is defined as ....

  (a) $\mathrm{F} = \mathrm{U} + \mathrm{TS}$ (b) $\mathrm{F} = \dfrac{\mathrm{U}}{\mathrm{TS}}$

  (c) $\mathrm{F} = \mathrm{U} - \mathrm{TS}$ (d) $\mathrm{F} = \mathrm{U} + \mathrm{PV}$

(Theory)

2. Attempt any *five* of the following questions : 10

  (i) Define self-diffusion.

  (ii) Define adiabatic process.

  (iii) Draw a neat labelled diagram of Andrew's experiment.

  (iv) Define critical temperature.

  (v) State first law of thermodynamics.

  (vi) State third law of thermodynamics.

  (vii) State Gibb's function of a system.

3. Attempt any *two* of the following questions : 10

  (i) Derive an expression for mean free path of a gas molecule.

  (ii) Explain Boyle temperature. Give its conclusions.

  (iii) Explain change in entropy in reversible process.

(*iv*) Prove the T.*d*S equation :

$$T \cdot dS = C_V dT + T \left(\frac{\partial P}{\partial T} \right)_V dV.$$

4. Attempt any *one* of the following questions : 10

(*i*) Describe Joule-Thomson Porous Plug experiment in detail.

(*ii*) Derive an expression for coefficient of viscosity of a gas.