SH-III/PHS/302/C-6/19

B.Sc. 3rd Semester (Honours) Examination, 2019-20

PHYSICS

Course ID : 32412 **Course Code : SH/PHS-302-C-6**

Course Title : Thermal Physics

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the margin indicate full marks.

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

1. Answer *any five* questions: 1×5=5

(a) State the zeroth law of thermodynamics.

(b) State with reasons whether internal energy is a state function or a path function.

(c) Assuming ideal gas behaviour estimate the number of moles in $1m^3$ of air under atmospheric pressure $(1 \cdot 014 \times 10^5\ N/m^2)$ at 0ºC.

(d) What are the units of 'a' and 'b' in van der Waal's equation of state?

(e) Under what condition a real gas will behave as an ideal gas?

(f) What do you mean by "most probable velocity" of gas molecules?

(g) Define 'inversion temperature' in case of liquefaction of gases.

(h) What is meant by enthalpy of a system?

Answer *any two* of the following: 5×2=10

2. (a) Define isothermal bulk modulus.

(b) Find the work done by a perfect gas during adiabatic process.

(c) Prove that, the slope of adiabatic curve through a point in PV graph is $\gamma\left(=\frac{C_p}{C_v}\right)$ times the slope of isothermal curve through the same point. 1+2+2=5

3. (a) Prove the thermodynamic relation: $Tds = C_v dT + T\left(\frac{\partial P}{\partial T}\right)_v dV$.

(b) Calculate the change in entropy if 2 gm of ice melts into water at NTP. Latent heat of ice = 80 cal/gm. 3+2=5

4. (a) Show that the probability of a gas molecule travelling a distance 'x' without suffering a collision is $e^{-\frac{x}{\lambda}}$, λ being mean face path of the gas.

(b) The mean free path of molecules in a certain gas is 4·0 cm. How many out of 10,000 free paths are longer than 4·0 cm? 4+1=5

5. (a) Explain the principle of cooling by the process of adiabatic demagnetization.

(b) Draw the P-V diagram for working of a reversible Carnot engine. 3+2=5

Answer *any one* question: 10×1=10

6. (a) Distinguish between reversible and irreverssible process.

(b) Prove the equivalence of Kelvin-Planck and Clausius statement of second law of thermodynamics.

(c) Show that entropy always increases in irreverssible process. 2+6+2=10

7. (a) Establish Maxwell velocity distribution formula–

$$dn = na^3 e^{-b(u^2+v^2+w^2)} dudvdw,$$

where the symbols have their usual meanings.

(b) It T_c, P_c and V_c are the critical values of temperature, pressure and volume, respectively, of a gas and 'a', 'b' are the van der Waal's constants, then show that, $V_c = 3b, P_c = \frac{a}{27b^2}$ and $T_C = \frac{8a}{27bR}$. 6+4=10

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