SH-III/Physics-302C-6(T)/19

B.Sc. Semester III (Honours) Examination, 2018-19

PHYSICS

Course ID : 32412 **Course Code : SHPHS-302C-6(T)**

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.

Section–I

1. Answer *any five* questions: 1×5=5

(a) What do you mean by thermodynamic equilibrium?

(b) State the law of correspondence states.

(c) What is Boyle temperature?

(d) Calculate the work done by 1 mole of gas during a quasi-static isothermal expansion from a volume V_i to a volume V_f, when the equation of state is $P(V–b) = RT$.

(e) State law of equipartition of energy.

(f) What is Gibbs potential?

(g) State the second law of thermodynamics in terms of entropy.

(h) What is temperature of inversion?

Section–II

Answer *any two* questions: 5×2=10

2. (a) What are critical constants of a gas?

(b) Obtain their values in terms of the constant of Van der Waals equation. 1+4=5

3. Derive the expression of co-efficient of viscosity using transport phenomenon. 5

4. Derive Clapeyron's equation $\frac{dP}{dT} = \frac{L}{T(V_2-V_1)}$, where the symbols have their usual meaning. What are the characteristics of a λ transition? 4+1=5

5. (a) Define entropy.

(b) Show that the change in entropy is independent of path.

(c) State briefly the physical significance of entropy. 1+2+2=5

Section–III

Answer *any one* question: 10×1=10

6. (a) Define Joule-Thomson effect.

(b) Show that the *J-T* co-efficient $\mu = \left(\frac{\partial T}{\partial P}\right)_H$ can be written as $\mu = \frac{1}{Cp}\left[T\left(\frac{\partial V}{\partial T}\right)_P - V\right]$. Symbols are of usual meanings.

(c) Show that *J-T* effect is zero for ideal gas.

(d) Write down the Maxwell's four thermodynamic relation.

(e) Prove $Tds = C_P\, dT - T\left(\frac{\partial V}{\partial T}\right)_P dP$. 1+3+2+2+2=10

7. (a) Deduce the expressions for the work in isothermal and adiabatic expansion of a perfect gas in terms of temperature.

(b) Explain what is meant by a reversible thermodynamic process.

(c) Prove that the efficiency of a carnot engine is $\eta = 1 - \frac{T_2}{T_1}$, where T_1 and T_2 are the temperature of source and sink respectively. 3+2+5=10

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