

B.Sc. 3rd Semester (Honours) Examination, 2020-21

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 of the following questions: 1×5=5

- a) What do you mean by 2nd order phase transition? Why is it called '2nd order'?
- b) Under which condition a thermodynamic process can be called reversible?
- c) Show that an adiabatic isentropic process must be reversible.
- d) What is thermodynamic equilibrium?
- e) What is no collision probability for gas molecules?
- f) How does diffusion coefficient of a gas vary with its temperature?
- g) Define isothermal compressibility of a material.
- h) What is Boyle's temperature? Relate it with critical temperature.

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

2. (a) Draw a reversible Carnot cycle on T-S plane.
(b) Give the idea of thermodynamic scale of temperature from second law of thermodynamics. 1+4
3. (a) Define internal energy (U) of a gaseous system.
(b) In thermodynamics, dW is not perfect differential – why?
(c) From first law of thermodynamics show that for perfect gas, $C_p - C_v = P \left(\frac{\partial V}{\partial T} \right)_P$.

1+1+3

P.T.O.

4. (a) What do you mean by entropy and unavailable energy?
 (b) 10g of water at 60°C is mixed with 30g of water at 20°C. Calculate the change in entropy of the system. 1+1+3

5. (a) Show that for an isothermal-isochoric spontaneous change of a system Helmholtz free energy must decrease.

(b) A gas obeys an equation $P(V-b)=RT$ (b is a constant). Show that $\left(\frac{\partial U}{\partial V}\right)_T = 0$

3+2

Answer any one of the following questions:

10×1=10

6. (a) Find the fraction of molecules in a close container at temperature 27°C having velocity in between C_0 and $1.02C_0$ where C_0 is the most probable velocity of the molecules. (b) What is transport phenomena? Find diffusivity for diffusion of gas molecules by using transport phenomena in kinetic theory of gas. (c) Discuss the effect of temperature and pressure on coefficient of viscosity of a gas. 1+1+5+3

7. (a) Show that the specific Gibbs potentials of two phases of a one component system, in equilibrium, have the same value. (b) Draw the variation of specific entropy and specific volume with temperature across a first order phase transition. (c) Define Joule-Kelvin coefficient and find its expression for a van der Waals' gas.

3+2+1+4
