

II Semester B.Sc. Examination, May/June 2007
(Semester Scheme)
PHYSICS – II
Properties of Matter, Heat and Thermodynamics

Time: 3 Hours

Max. Marks: 60

PART – A

I. Answer **any five** of the following questions. **Each** question carries **six** marks : **(5×6=30)**

- 1) a) Define Poisson's ratio.
- b) Obtain the equation connecting young's modulus, rigidity modulus and Poisson's ratio. **(1+5)**
- 2) a) Write Euler's equation for liquid flow.
- b) Deduce Bernoulli's equation from Euler's equation. **(2+4)**
- 3) Give the theory of interfacial tension by drop-weight method. **6**
- 4) Deduce an expression for the mean free path of the gas molecules. **6**
- 5) a) What are isobaric and isochoric processes ?
- b) Deduce an expression for the work done during adiabatic process. **(2+4)**
- 6) a) Write an expression for the change in entropy.
- b) Deduce an expression for the change in entropy during an Isobaric process. **(2+4)**
- 7) a) Explain the terms Gibbs and Helmholtz's free energies.
- b) Write the four Maxwell's thermodynamical equations and hence obtain Clausius Clapeyron equation. **(2+4)**
- 8) a) Describe the porous plug experiment.
- b) Deduce the relation between inversion temperature and critical temperature. **(4+2)**

PART - B

II. Answer **any four** questions. **Each** question carries **five** marks : (5×4=20)

- 9) When a wire of length 3 m and radius 1.5×10^{-4} m is stretched by a force of 0.6 kg wt, the extension is found to be 1.32×10^{-3} m. Find
- Young's modulus and
 - The energy stored in the wire.
- 10) Water flows along the horizontal pipe of non-uniform cross-section. The pressure is 30 mm of mercury where the velocity is 0.2 ms^{-1} . Find the pressure at a point where the velocity is 1.2 ms^{-1} .
- 11) Two plates each of area $1 \times 10^{-3} \text{ m}^2$ are separated by a thin layer of water. If the distance of separation between the plates is 1×10^{-5} m, calculate the force holding the plates together. Surface tension of water = 0.075 Nm^{-1} .
- 12) At what temperature will oxygen molecules have the same rms velocity as that of hydrogen molecules at 100°C ? Mass of oxygen atom is 16 times that of hydrogen atom.
- 13) A gasoline engine performs 2200 J of mechanical work and discards 2000J of heat in each cycle.
- How much heat must be supplied to the engine in each cycle ?
 - What is the efficiency of the engine ?
- 14) Calculate the change in temperature, when helium gas suffers Joule-Thomson expansion at -10°C . The pressure difference on two sides of the plug is 10 atmospheres and Vander Waal's constant for the gas are $a = 0.0341 \times 10^{-1} \text{ Nm}^4 \text{ mole}^{-2}$ $b = 2.37 \times 10^{-5} \text{ m}^3 \text{ mole}^{-1}$ and $R = 8.3 \text{ Jk}^{-1} \text{ mole}^{-1}$.

PART – C

III. Answer **any five** questions. **Each** question carries **two** marks : **(2×5=10)**

- 15) a) Which one of the three moduli of elasticity is present in all three states of matter ?
- b) A small solid sphere dropped into a vertical column of liquid moves down with uniform velocity, where as an air bubble inside the column rises up with uniform velocity explain.
- c) Small drops of liquid are usually spherical in shape. Explain.
- d) An ascending balloon filled with hydrogen bursts. Explain.
- e) Write P-V-diagram for adiabatic and isothermal processes.
- f) Gibbs free energy is called thermodynamic potential at constant pressure why ?
- g) What is meant by adiabatic demagnetisation ?
- h) In which state is the entropy maximum, solid, liquid or gas ? Why ?
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