

1ST B. SC. 1ST SEMESTER, 2019
 Physics (Honours)
 Paper: HO- 2

Time: Two Hours

Full Marks: 50

Use separate answer scripts for each group

GROUP A

Answer question no. 1 and any three from the rest

- 1.(a) Starting from the expression of pressure according to kinetic theory, establish (i) the Avogadro's hypothesis and (ii) Clapeyron's equation .
- (b) Write down the Maxwell's law of distribution of molecular speed in three dimension.
- (c) Find out expression for the root mean square speed.
- (d) Find the kinetic energy associated with the chaotic motion of one mole of an ideal monoatomic gas at absolute temperature T.
- [4+1+3+2]
2. Define mean free path of a gas molecule. Assuming that all molecules are moving with the same average velocity \bar{C} , show that the mean free path can be expressed as $\lambda = \frac{3}{4\pi\sigma^2n}$. All symbols are of usual significance.
- [1+4]
3. Transport phenomena occur in a gas when thermodynamic equilibrium is disturbed. Indicate in each of the following situations the physical quantity that is transported when (i) thermal equilibrium is disturbed, (ii) chemical equilibrium is disturbed. Write down the expression for coefficient of viscosity of a gas. Discuss its pressure dependence.
- [2+3]
4. Deduce the working formula of Perrin's experiment for determining Avogadro number from vertical distribution of Brownian particles.
- [5]
5. Plot a isotherm of a real gas below critical temperature. Indicate the different regions. Define critical constants of the gas.
- [1+1+3]
6. Set up the Fourier's equation for the rectilinear flow of heat in a straight linear conductor and solve it for steady state.
- [3+2]

BACHELOR OF SCIENCE EXAMINATION, 2019 (Old)
 (1st Year, 1st Semester)
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Group-B

Answer Q. No. 1 and any two from the rest.

1. Write short note (any one): 3
- a) Gravitational self-energy.
 - b) Stokes law and terminal velocity.
2. a) Find an expression for the gravitational potential due to a thin spherical shell at a point outside the shell.
- b) Describe a compound pendulum and show the centres of oscillation and suspension for a given compound pendulum are interchangeable.
- c) Distinguish between stream-line motion and turbulent motion of a fluid. 4+5+2=11
3. a) A straight beam of rectangular cross-section, rigidly clamped at one end, is loaded at the free end with a weight W . Obtain an expression for the depression at the middle of the beam, if the weight of the beam is negligible.
- b) A cylindrical rod of length l and radius a is stretched such that the volume of the rod is not changed. Show that the Poisson's ratio is $\frac{1}{2}$.
- c) Explain the reciprocal theorem for a cantilever having negligible mass. 5+3+3=11
4. a) Show that the excess pressure acting on the curved surface of a membrane is given by
- $$p = 2S \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$$
- Where r_1 and r_2 are the radii of curvature and S the surface tension of the membrane.
- b) Calculate the force to pull a horizontal plate upwards from a liquid surface.
- c) Two spherical soap bubbles of diameters 10 cm and 6 cm respectively are formed, one at each end of a narrow horizontal glass tube. What is the pressure difference between the ends of the tube? ($S = 30$ dyne/cm) (5+3+3)=11