

BACHELOR OF SCIENCE EXAMINATION – 2018
(1st Year, 1st Semester)
PHYSICS (Subsidiary)
Paper – SO2

Time : Two Hours

Full Marks : 50

Answer Any Four Questions

1. a) An ideal gas obeys the relation $PV^n = \text{Constant}$. Identify the process for $n = 0, 1$ and 1.4 when the system changes its state.
b) State and explain the 1st law of thermodynamics.
c) One mole of an ideal gas expands from a state (V_1, T_1) to a state (V_2, T_2) by quasistatic adiabatic process. Show that the work done by the gas is proportional to $(T_1 - T_2)$. Find the change in internal energy of the gas. (3+4+5.5)
 2. a) Describe Carnot's Cycle and explain Carnot's theorem. Find out the efficiency of a Carnot's engine in terms of source and sink temperature.
b) A Carnot's engine which operates between a source (temperature 1100K) and a sink (temperature T_2) has efficiency 28%. It absorbs 60 KCal heat from external source. Find out the work done by the engine and the temperature T_2 . (8+4.5)
 3. a) What do you mean by 'entropy'? 10 gm of ice at 0°C melts into 10 gm of water. Find out the change in enthalpy. Latent heat for melting of ice is 80 Cal/gm.
b) Starting from the Fourier equation for one dimensional heat flow through a conductor find out its steady state solution. (6+6.5)
 4. a) Write down the basic assumptions of the kinetic theory of gases.
b) From these basic assumptions calculate the expression of pressure of the idea gas. (4.5 +8)
 5. What do you mean by the root mean square velocity of gas? Write down its expression in terms of temperature. Write down the expression of Maxwell's velocity distribution law. What do you mean by
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most probable velocity? From the expression of Maxwell's velocity distribution estimate the expression of most probable velocity. (2+1.5+3+2+4)

6. a) What are the reasons for the correction of gas laws by Van der Waals? What are those corrections?

b) Carbon dioxide gas (1.00 mole) at 373 K occupies 536 mL at 50.0 atmosphere pressure. What is the calculated value of the pressure using

(i) Ideal gas equation

(ii) Van der Waals equation?

[Data - Van der Waals constants for carbon dioxide:

$a = 3.61 \text{ L}^2 \text{ atm mol}^{-2}$; $b = 0.0428 \text{ L mol}^{-1}$]

(4.5+4+4)

7. What are the critical constant of real gases? Estimate the critical constants in terms of Van der Waals' gases. (4+8.5)