Homework: 2   Submission Date: 23/1/2024

The hand written solutions must be submitted at the start of the tutorial.

1. Calculate the work done by 1 mole of a gas during a quasistatic isothermal expansion from a volume V_i to a volume V_f, when the equation of state is $pV = RT(1 - B/V)$.

2. n moles of an ideal gas is made to undergo cyclic change $ABCA$ consisting of the following processes. (i) $A \rightarrow B$: Isothermal expansion at temperature T so that the volume is doubled from V_1 to $V_2 = 2V_1$ and pressure changes from p_1 to p_2. (ii) $B \rightarrow C$: Isobaric compression at pressure p_2 to initial volume V_1. (iii) $C \rightarrow A$: Isochoric change leading to change of pressure from p_2 to p_1.

   (a) In the p - V diagram, draw the process.

   (b) Obtain expression for the work done for each step

   (c) Obtain the change in internal energy for each part.

   (d) What is the total change in the internal energy in the whole process? Justify why you get this answer.

3. Consider a van der Waals' gas for which it is given that $(\partial U / \partial V)_T = a/V^2$. If the gas is allowed to do free expansion, i.e the internal energy remains constant, using the above expression, argue that the temperature will fall as expansion happens.

4. Calculate the quantity of heat absorbed, the increase in internal energy and the work done by the gas when the temperature of 30 g of oxygen is raised from 30^0 C to 100^0 C (a) at constant pressure and (b) at constant volume. From the internet find values of R, C_V and molecular weight of oxygen.