B. Sc. (Chemistry Hons)

Thermodynamics 01

Continued 15/04/2020

Carnot Cycle

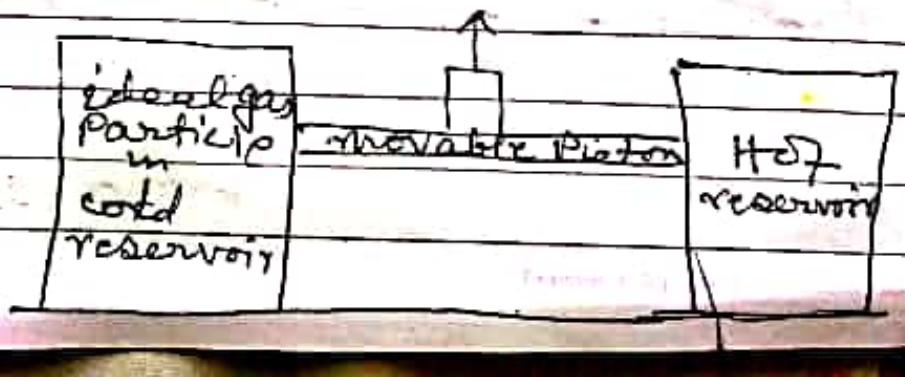
Prof. Ashok
Dept. of Chemistry
S.N.S.R.K.S. College
Saharsa

In the last class we have discussed about Carnot cycle, when acting as a heat engine consists of four stages. We have discussed stage I in the last class.

Now, we have to discuss about three other stages -

Stage II

At this stage expansion continues however there is no heat exchange between system and surroundings. Thus the system is undergoing adiabatic expansion. The expansion allows the ideal gas particles to cool, decreasing the temperature of the system.



(2) Isentropic (reversible adiabatic) ⇒

For this step the gas in the engine is thermally insulated from both the hot and cold reservoirs. Thus they neither gain or lost heat an adiabatic process. The gas continues to expand by reduction of pressure, doing work on the surroundings and losing an amount of internal energy equal to the work done. The gas expansion without heat input causes it to the cool to the cold temperature Tc the entropy remains unchanged.

Stage - III

At this stage the surroundings do work on the system which causes heat to be released (q_c). The temperature within the system remains the same. Thus isothermal compression occurs.

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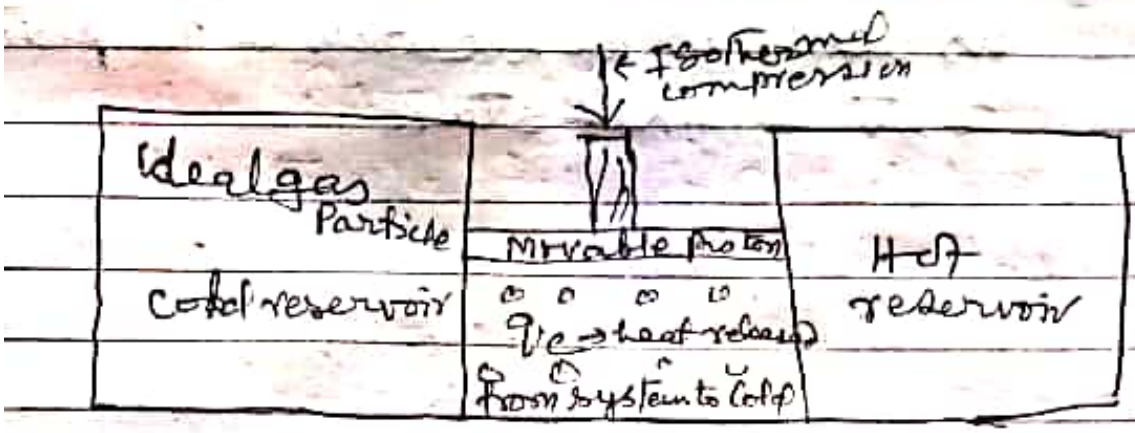


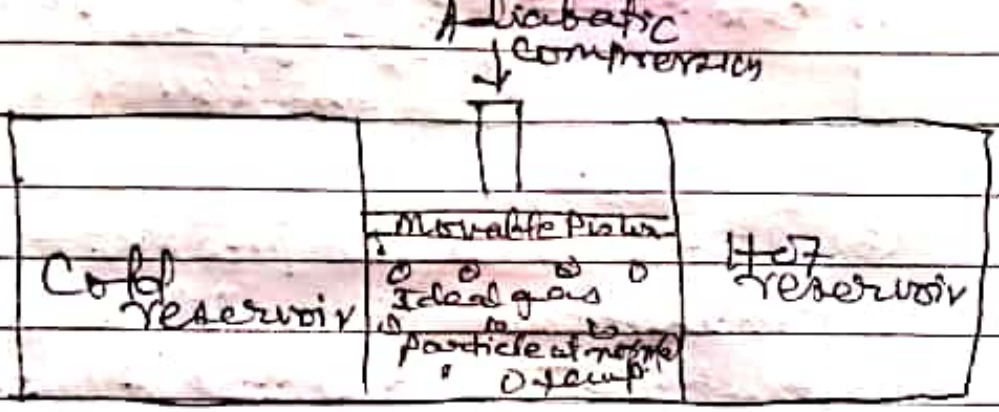
(3) Isothermal Compression ⇒ Heat transferred reversibly to low temperature reservoir at low temperature. Now the gas in the engine is in thermal contact with the cold reservoir at temperature Tc. The surrounding do work on the gas pushing the piston down, causing an amount of heat energy, to leave the system to the low temperature reservoir and the entropy of the system to decreased by the amount

$$\Delta S_2 = Q_2 / T_c$$

Stage - IV

No heat exchange occurs at this stage, however the surroundings continue to do work on the system. Adiabatic Compression occurs which raises the temperature of the system

as well as the location of the piston ba to its original stage



4) Adiabatic reversible compression :—
Once again the gas in the engine is thermally insulated from the hot and cold reservoirs and the engine is assumed to be frictionless, hence reversible. During this step the surroundings do work on the gas, pushing the piston down further, increasing its internal energy, compressing it and causing its temperature to rise back to the safely to the work added to the system but the entropy remains unchanged. At this point the gas is in the same state as at the start of step-I