B. Sc. (Chemistry Hons) 01

18/04/2020

Continued

Thermodynamics

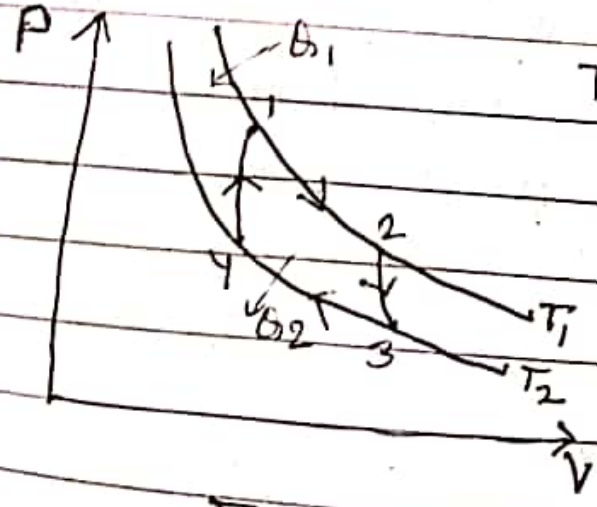
Prof. Ashok.
Dept. of Chemistry
S.N.S.R.K.S. College
Saharsa.

Carnot Cycle

We have already discussed Carnot cycle when acting as a heat engine consists of the following four steps

1) Isothermal Expansion
2) Isenthopic (reversible adiabatic)
3) Isothermal Compression
4) Adiabatic reversible Compression.

Now a Carnot cycle illustrated on a PV diagram to illustrate the work done :-



$T_1 > T_2$

Fig-1

Teacher's Signature.....

Scanned with CamScanner

In this case

$$\Delta S_1 = \Delta S_2$$

$$\text{or } Q_1/T_h = \frac{Q_2}{T_c}$$

This is true as Q_2 and T_c are both lower and in fact are in the same ratio as Q_1/T_h

The Pressure-volume graph:-

When the Carnot cycle is plotted on a pressure-volume diagram Fig-1, the isothermal stages follow the isotherm lines for the working fluid, the adiabatic stages moves between isotherms and the area bounded by the complete cycle path represents the total work that can be done during one cycle. From Point 1 to 2 and point 3 to 4 the temperature is constant. Heat transfer from Point 4 to 1 and 2 to 3 are equal to zero.

Temperature-Entropy diagram

Scanned with CamScanner

hot reservoir at temperature T_H and a Cold reservoir at temp. T_C. By the Second law of thermodynamics the cycle cannot extend outside the temperature band from T_C to T_H. The area in coloured Q_C is the amount of energy exchanged between the system and the Cold reservoir. The area in white W is the amount of work energy exchanged by the System with its surroundings. The amount of heat exchange with the hot reservoir is the sum of the two. If the system is behaving as an engine, the process moves clockwise around the loop and moves counter clockwise if it is behaving as a refrigerator. The efficiency to the cycle is the ratio of the white area (work) divided by the sum of the white and coloured areas (heat absorbed from the hot reservoir.

End

03
18/04/2020

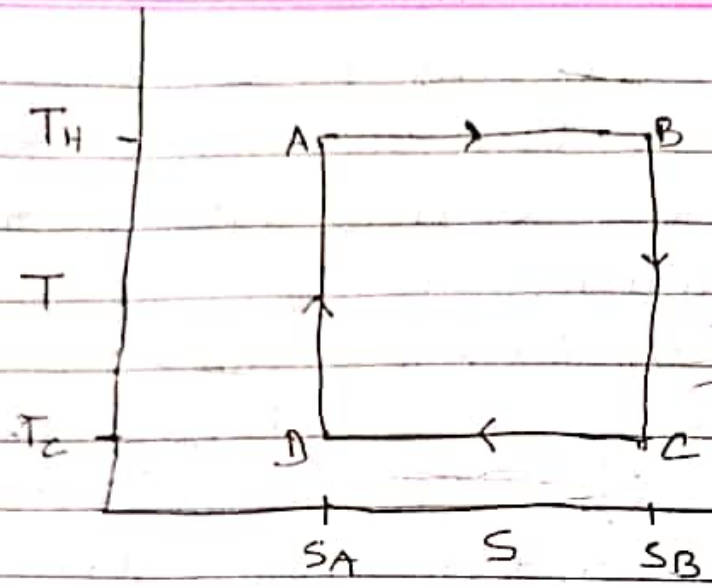
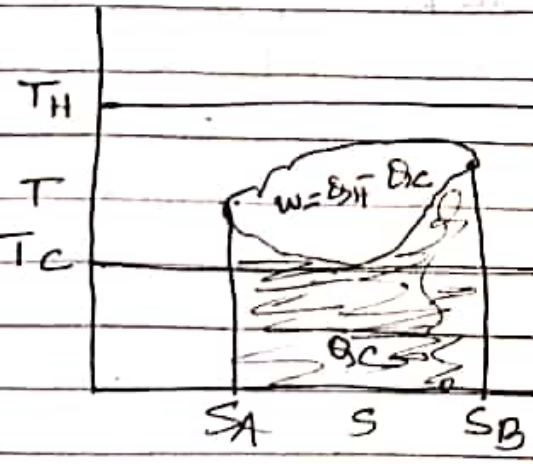


Fig - 2

A Carnot cycle acting as a heat engine illustrated on a temperature-entropy diagram. The cycle takes place between a hot reservoir at temperature T_A and a cold reservoir at ~~no~~ temperature T_B. The vertical axis is temperature and the horizontal axis is entropy.



A generalised thermodynamic cycle taking place between a

Scanned with CamScanner