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Eklavya 2021

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Anand Prakash
Co-Founder, Vedantu
IIT- Roorkee

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Our Previous EKLAVYANs & Their Achievements

Student Name	Main Rank	Advanced Rank
Chirag Jain	731	41
Prakhar Agrawal	445	177
Tanmay Gangwar	2133	227
Aditya Kukreja	1772	635
Eknoor Singh	3574	1243
Aditya Gupta	14275	1326

547 JEE Advanced Selections in 2020

Study Materials

- JEE Main & Advanced – Free Study Material
- NEET UG – Free Study Material
- NCERT Solutions for Class 1 to 12
- NCERT Books PDF for Class 1 to 12
- ICSE & ISC Free Study Material
- Free Study Material for Kids Learning (Grade 1 to 5)
- Olympiad Free Study Material
- Reference Books (RS Aggarwal, RD Sharma, HC Verma, Lakhmir Singh, Exemplar and More)
- Previous Year Question Paper CBSE & State Boards
- Sample Papers
- Access All Free Study Material Here

THERMODYNAMICS

THERMODYNAMICS

Thermodynamics is concerned with the work done by a system and the heat it exchanges with its surroundings.

When the system is taken quasistatically from the equilibrium state *i* to another equilibrium state *f*, the total work done by the system is

$$W = \int_{V_i}^{V_f} P \, dV$$

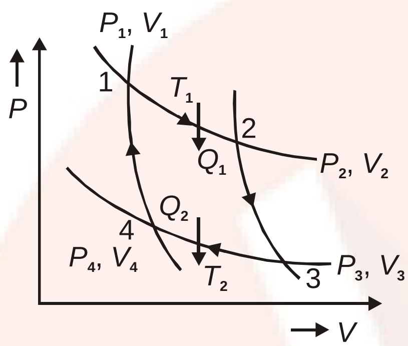
The work is represented by the *area under the curve*. If $V_f > V_i$, the work done by the gas is ***positive***. If the volume *decreases*, the work done by the gas is ***negative***.

FIRST LAW OF THERMODYNAMICS

We know that both the total work done *W* and the total heat transfer *Q to* or *from* the system depend on the thermodynamic *path*. However, the difference $Q - W$, is the same for *all* paths between the given *initial* and *final* equilibrium states, and it is equal to the change in internal energy ΔU of the system.

$$\Delta U = Q - W$$

APPLICATIONS OF THE FIRST LAW OF THERMODYNAMICS



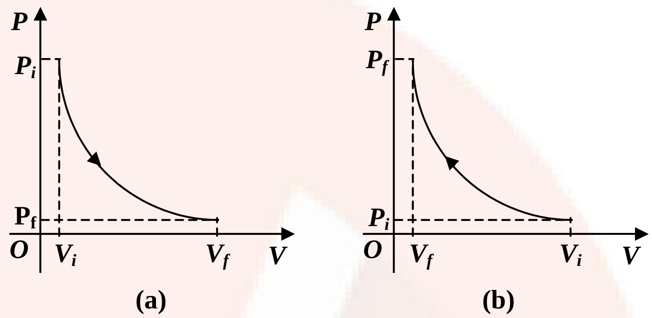
$1 \to 2$	Isothermal Expansion	$\Delta U = 0$ $W_1 = Q_1 = nRT \ln \frac{V_2}{V_1}$ (positive)
$2 \to 3$	Adiabatic Expansion	$Q = 0$ $W_2 = -\Delta U = \frac{nR\Delta T}{1-r}$
$3 \to 4$	Isothermal Compression	$\Delta U = 0$ $W_3 = Q_2 = nRT \ln \left(\frac{V_4}{V_3}\right)$ (negative)
$4 \to 1$	Adiabatic Compression	$Q = 0$ $W_4 = -\Delta U = \frac{nR\Delta T}{1-r}$

Important

1. $C_p - C_v = R$

2. $\frac{C_p}{C_v} = \gamma$

(d) Isothermal Process



PV diagram of isothermal process
(a) Isothermal expansion
(b) Isothermal compression

In an isothermal process, temperature of the system remains constant. For an ideal gas the equation of the process is given by

$PV = nRT$

= constant

Work done in an isothermal process is given by

$$W = \int_{V_i}^{V_f} P dV = nRT \int_{V_i}^{V_f} \frac{dV}{V}$$

or $$W = nRT \ln \left| \frac{V_f}{V_i} \right|$$

Since temperature of the system remains constant, therefore, there is no change in internal energy.

$$\Delta U = nC_v\Delta T = 0$$

(e) Adiabatic Process

In an adiabatic process, the system does not exchange heat with the surroundings,
i.e. $Q = 0$.

For an ideal gas the equation of the adiabatic process is

$$PV^{\gamma} = \text{constant}$$

Where, γ is the adiabatic exponent.

Work done: $W = \int_{V_i}^{V_f} PdV$