PHYSICS CLUB

STEM ASYUT

Grade 10

PHYSICS
LO.11

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Table of Content:

Important Resources :

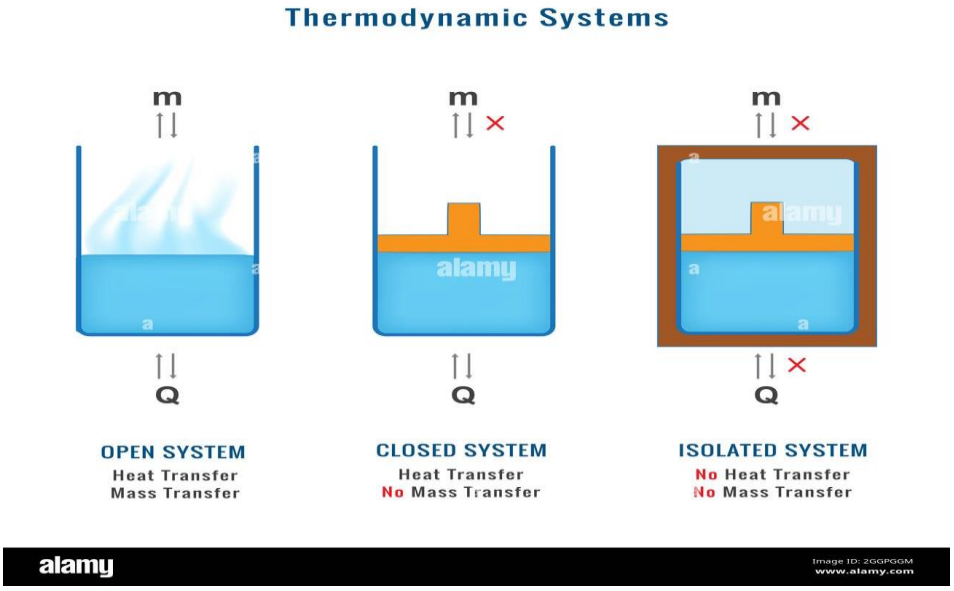
1. https://youtu.be/MPHZGvyJ8fs?si=YnrBgedxwQDrs62c
2. https://youtu.be/NyOYW07-L5g?si=YO--DBHFH0I2BL-6
3. https://youtu.be/TnDCxw0y6YM?si=T-IkWuqTxJmaamXW
4. https://drive.google.com/drive/folders/1k7gouLjKejljYDMzc2ZOBJT6Dv1DsknB?usp=sharing
5. Halliday Ch.18
6. Serway Part.3

What is a system :

A system that is delimited from the surroundings by real or hypothetical boundaries

There are 3 types of systems in thermodynamics:

1. **Open System** :
   The matter and energy can be transferred in and out of the open system.
2. **Closed System**:
   Only heat can be transformed in and out of the system.
3. **Isolated System**:
   Energy or matter can't enter or leave an isolated system.



In Physics

If the work was done by the system:

The **W** is **Positive**.

If the work was done on the system:

The **W** is **Negative**.

THE FIRST LAW OF ENERGY (law of energy conservation) :

The first law of thermodynamics is a generalization of the principle of conservation of energy to Include energy transfer through heat as mechanical work.

Types of heat transfer:

1 – Specific heat :

the amount of heat that must be added to one unit of mass of the substance to cause an increase of one unit in temparture**.**

Q = m c t

M is **mass**

C is **specific heat** note: (each substance has the same specific heat)

Q is **the amount of energy we need it**

T is **the difference between t final t and t initial**

Note:

- When the temperature increases Q will be positive
- When temperature decreases Q negative

2- latent heat:

latent heat is a heat when substance change from case to another case as: solid, liquid

Q = mL

L=Q/M

Q is the amount of energy

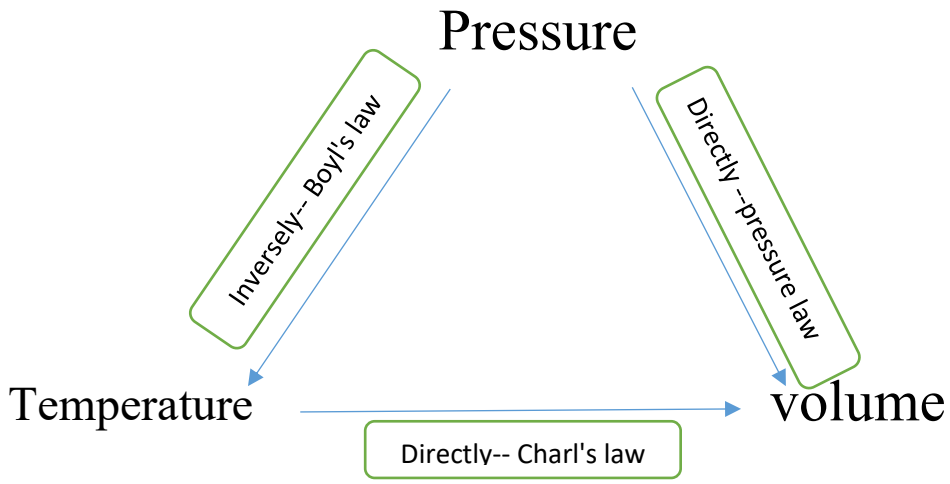
M is the mass

L is 3 types

1**- L** of fusion (change substance from solid to liquids)

2**- L** of vibration (change substance from liquid to gas)

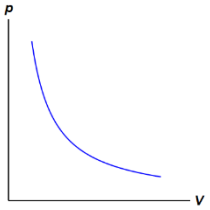
3- **L** of sublimation (change in gas of gases)



Thermal energy: The total thermal energy of an isolated system remains constant over time.

In other words, energy cannot be created or destroyed, only converted from one form to another. This principle applies to all forms of energy, including thermal energy.

Boyl's law: studies the relation between volume and pressure (constant temperature)



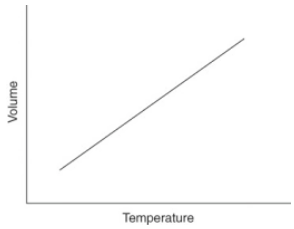
The law: $P_1 v_1 = P_2 v_2$

For example: A certain amount of a gas volume 350 $cm3$ at a pressure 2 atm. Then its volume under the atmospheric pressure at the same temperature will be ……cm3

1-400 2-650 3-700 4-850

Charle's law: studied the relation between volume and temperature (constant pressure):

The law: $\frac{v_1}{v_2} = \frac{T_1}{T_2}$



Pressure law : studied he relation between pressure and temperature (constant volume)

The law: $\frac{p_1}{p_2} = \frac{T_1}{T_2}$

- **General laws of gas** :
- $\frac{p_1 v_1}{T_7} = \frac{p_2 v_2}{T_2}$
- $\frac{pv}{t} = NR$

First law of thermodynamics :

$$Q = w + \Delta u$$

Q: heat energy

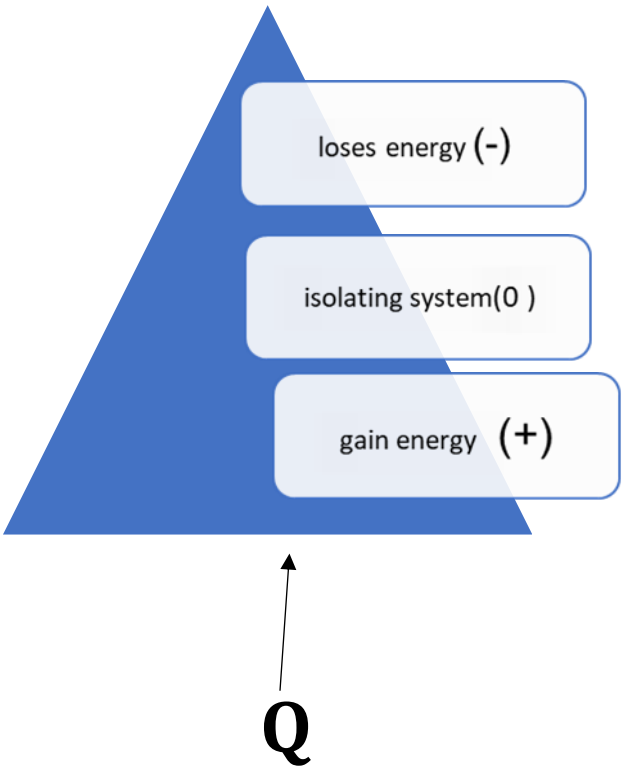
W: work (depends on volume) if volume =0 don't find the work

U: internal energy (depend on temperature)

Heat energy gained or lose (Q)

- $Q = mc\Delta t$(solid or liquid)
- Q $= ncp\Delta t$(gas) at constant pressure
- $Q = ncv\Delta t$(gas) at constant volume

n: means number of moles



Work done depends on change on volume:

The work done is given by the formula $W = \int PdV$, where $\int$ represents integration,

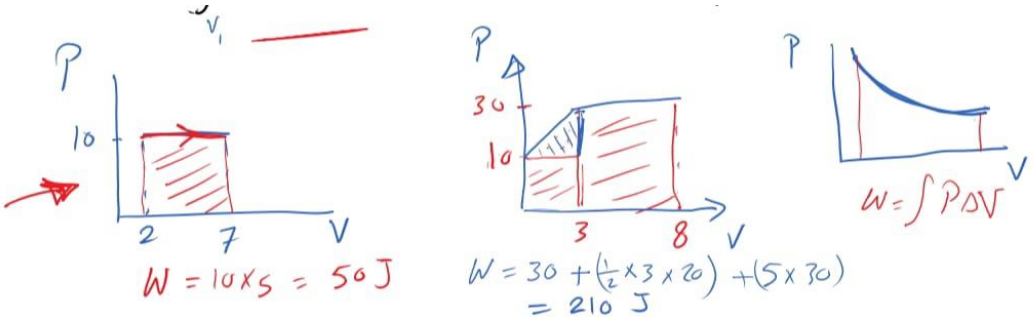
P is **the pressure of the gas**,

and **dV** is **the change in volume of the gas**.

If the pressure of the gas is constant, the formula simplifies to $W = P\Delta V$, where ΔV is the change in volume of the gas

probability to find the work by :

work: (area under the curve between p-v)



Volume decrease (-)

Constant(0)

volume increase (+)

internal energy (▲u)

▲u depends on change in temperature

▲u=ncv▲t

Special Cases

1. Isobaric Process:

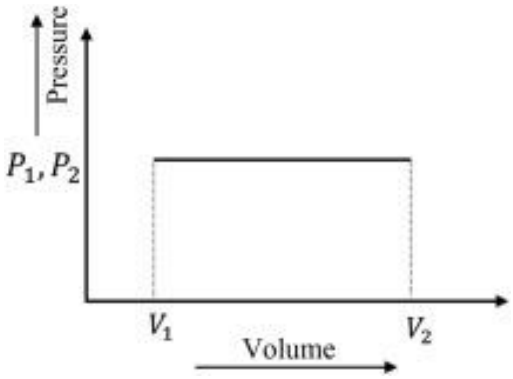
   The pressure is constant , $\Delta p = 0$

$$W = p(v_f - v_i)$$

$$\frac{pv}{t} = constant$$

$$\frac{P_1 v_1}{T_1} = \frac{P_2 v_2}{T_2}$$

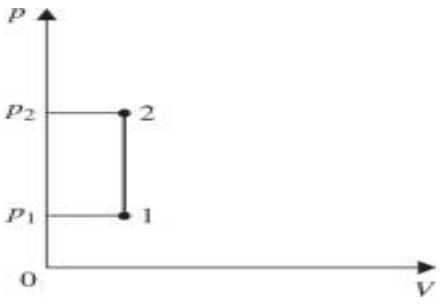
$$\frac{v_1}{T_1} = \frac{v_2}{T_2}$$



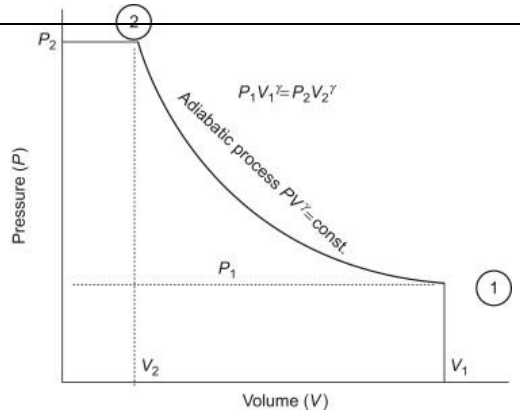
2. Isovolumetric Process :

   The volume is constant , W= 0 , $\Delta u = Q$

$$\frac{P_1}{T_1} = \frac{p_2}{T_2}$$



3. Adiabatic Process :



Q=0 , $\Delta u = -W$

4. Isothermal Process :

T is constant

$T \alpha u$

u is constant , $\Delta u = 0$

T = 0 ,

Q = W