



DELHI POLICE CONSTABLE

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AVOGADRO HYPOTHESIS





The balloons all have the same volume. This means they all contain the same number of molecules.



Thermodynamical System

• An assembly of an extremely large number of particles whose state can be expressed in terms of pressure, volume and temperature, is called thermodynamic system.



• Thermodynamic system is classified into the following three systems

• (i) **Open System** It exchange both energy and matter with surrounding.



• (ii) **Closed System** It exchanges only energy (not matter) with surroundings.



(iii) Isolated System It exchanges neither energy nor matter with the surrounding



• (i) Isothermal Process

- A process taking place in a thermodynamic system at constant temperature is called an isothermal process.
- Isothermal processes are very slow processes.
- These process follows Boyle's law, according to which pV = constant.
- Examples
- (a) Melting process is an isothermal change, because temperature of a substance remains constant during melting.
- (b) Boiling process is also an isothermal operation.

• (ii) Adiabatic Process

• A process taking place in a thermodynamic system for which there is no exchange of heat between the system and its surroundings.

- Adiabatic processes are very fast processes.
- These process follows Poisson's law, according to which

• (iii) Isobaric Process A process taking place in a thermodynamic

system at constant pressure is called an isobaric process.

• (iv) Isochoric Process A process taking place in a tlaermodynars

system at constant volume is called an isochoric process

• **(v) Cyclic Process** When a thermodynamic system returns to its initial state after passing through several states, then it is called cyclic process.

Zeroth Law of Thermodynamics

According to this law, two systems in thermal equilibrium with a third system separately are in thermal equilibrium with each other. Thus, if A and B are separately in equilibrium with C, that is if T = T and T = T, then this implies that T = T i.e., the systems A and B are also in thermal equilibrium.

Zeroth law of thermodynamic can be describe as:



- First Law of Thermodynamics

- Heat given to a thermodynamic system (ΔQ) is partially utilized in doing work (ΔW) against the surrounding and the remaining part increases the internal energy (ΔU) of the system.
- Therefore, $\Delta Q = \Delta U + \Delta W$

• In isothermal process, change in internal energy is zero ($\Delta U = 0$). Therefore, $\Delta Q = \Delta W$

• In adiabatic process, no exchange of heat takes place, i.e., $\Delta \theta = O$. Therefore, $\Delta U = -\Delta W$

 In adiabatic process, if gas expands, its internal energy and hence, temperature decreases and vice-versa.

• In isochoric process, work done is zero, i.e., $\Delta W = 0$, Therefore $\Delta Q = \Delta U$

• Second Law of Thermodynamics

 The second law of thermodynamics gives a fundamental limitation to the efficiency of a heat engine and the coefficient of performance of a refrigerator. It says that efficiency of a heat engine can never be unity (or 100%). This implies that heat released to the cold reservoir can never be made zero.

Kelvin's Statement

• It is impossible to obtain a continuous supply of work from a body by cooling it to a temperature below the coldest of its surroundings.

Clausius' Statement

• It is impossible to transfer heat from a lower temperature body to a higher temperature body without use of an extenal agency.

Planck's Statement

- It is impossible to construct a heat engine that will convert heat completely into work.
- All these statements are equivalent as one can be obtained from the other.



- Entropy is a physical quantity that remains constant during a reversible adiabatic change.
- Change in entropy is given by $dS = \delta Q / T$
- Where, δQ = heat supplied to the system and T = absolute temperature.
- Entropy of a system never decreases, i.e., $dS \ge o$.
- Entropy of a system increases in an irreversible process



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