Classification of Adsorption.

Adsorption can be classified into two categories as described below.

(1) **Depending upon the concentration**: In adsorption the concentration of one substance is different at the surface of the other substance as compared to adjoining bulk or interior phase.
(i) **Positive adsorption**: If the concentration of adsorbate is more on the surface as compared to its concentration in the bulk phase then it is called **positive adsorption**.
Example: When a concentrated solution of KCl is shaken with blood charcoal, it shows positive adsorption.

(ii) **Negative adsorption**: If the concentration of the adsorbate is less than its concentration in the bulk then it is called **negative adsorption**.
Example: When a dilute solution of KCl is shaken with blood charcoal, it shows negative adsorption.

(2) **Depending upon the nature of force existing between adsorbate molecule and adsorbent**
(i) **Physical adsorption**: If the forces of attraction existing between adsorbate and adsorbent are Vander Waal's forces, the adsorption is called physical adsorption. This type of adsorption is also known as **physisorption or Vander Waal's adsorption.** It can be easily reversed by heating or decreasing the pressure.

(ii) **Chemical adsorption**: If the forces of attraction existing between adsorbate particles and adsorbent are almost of the same strength as chemical bonds, the adsorption is called chemical adsorption. This type of adsorption is also called as **chemisorption or Langmuir adsorption.** This type of adsorption cannot be easily reversed.

Comparison between physisorption and chemisorption

Physisorption (Vander Waal's adsorption)	**Chemisorption** (Langmuir adsorption)
Low heat of adsorption usually in range of 20-40 kJ/mol	High heat of adsorption in the range of 50-400 kJ/mol
Force of attraction are **Vander Waal's forces**.	Forces of attraction are **chemical bond forces.**
It is reversible	It is irreversible

It is usually takes place at **low temperature** and decreases with increasing temperature.	It takes place at **high temperature**.
It is related to the case of liquefication of the gas.	It is not related.
It forms **multimolecular layers**.	It forms **monomolecular layers**.
It does not require any activation energy.	It requires high activation energy.
High pressure is favorable. Decrease of pressure causes **desorption**	High pressure is favorable. Decrease of pressure does not cause desorption.
It is not very specific.	It is highly specific.

Note:Adsorption of gases on animal charcoal and adsorption of water vapors on silica gel is physical adsorption.

The behavior of adsorption of N_2 on iron clearly distinguishes between **physisorption and chemisorption**. At 83 K, nitrogen is physisorbed on iron surface as N_2 molecules. The amount of N_2 adsorbed decreases rapidly as the temperature increases at room temperature, practically, there is no adsorption of N_2 on iron. However at 773 K and above, nitrogen is **chemisorbed** on the iron surface as nitrogen atoms.

Due to formation of multilayers physical adsorption decreases after some times.
Chemisorption and physisorption both are **exothermic.**