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Transition Elements
Session 4

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Learning Objectives

- **Characteristics of Transition Elements**
  - ***Variable Oxidation State, Catalyst and Complex Ion Formation***

Characteristics of Transition Elements: 4. Variable Oxidation State

Transition elements show more than one *(or multiple or variable)* oxidation state.

❖ ***Reason*:**

Transition elements after losing valence electrons becomes unstable, so to become stable they lose one or more electrons further.

Characteristics of Transition Elements: 4. Variable Oxidation State

Example:

Fe = 2, 8, 14, 2

Iron (Fe) *loses 2 valence electrons* to become iron ion (Fe^{2+}) hence, it shows the *oxidation state of +2*.

Fe^{2+} = 2, 8, 14

Q. Since the Fe^{2+} is unstable, it further *loses one more electron* to become Fe^{3+} with the *oxidation state of*_____.

Fe^{3+} = 2, 8, 13


2M NH_3
Ammonia solution
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Characteristics of Transition Elements: 5. Catalytic Properties

Catalyst: Are substance that change the speed of chemical reaction.

Transition elements are used as catalyst in the following reaction:

1. ***Haber Process:***

It is the process of preparation of ammonia (NH_3).

*Transition element **iron (Fe)** is used as catalyst in Haber process*

$$N_2 + 3H_2 \xrightleftharpoons{Fe} 2NH_3$$

Source: Indiamart

Characteristics of Transition Elements: 5. Catalytic Properties

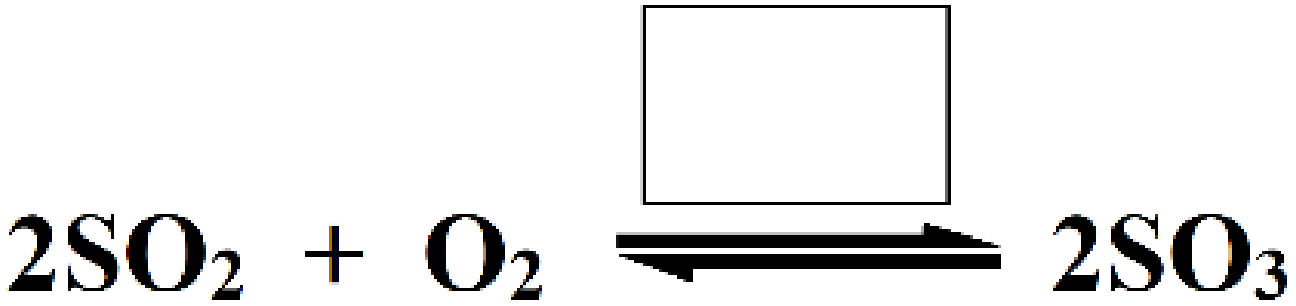
Catalyst: Are substance that change the speed of chemical reaction.

Transition elements are used as catalyst in the following reaction:

***2. Contact Process*:**

It is the process of preparation of sulphur trioxide (SO_3).

In Contact process vanadium (V) is used as catalyst in the form of vanadium oxide (V_2O_5).



$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

Source: Indiamart

Characteristics of Transition Elements: 5. Catalytic Properties

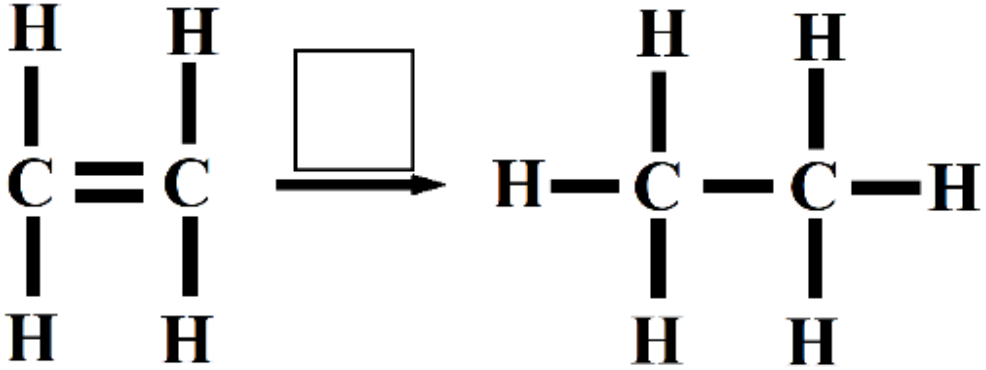
Catalyst: Are substance that change the speed of chemical reaction.

Transition elements are used as catalyst in the following reaction:

***3. Hydrogenation of alkene*:**

It is the process of adding hydrogen in alkene to make it alkane.

Catalyst Nickel (Ni) is used in hydrogenation of alkene



Characteristics of Transition Elements: 6. Complex Ion Formation

- The transition metal by losing electrons forms positive charged ion.
- And this metal ion bonds with other molecules.
- The metal ion is surrounded by other molecules.
- Hence, this metal ion is known as *Central Metal Ion.*

Q. What is other molecule known as?

Example: Iron (Fe)

- The molecules that is bonded with central metal ion is known as *Ligands*.

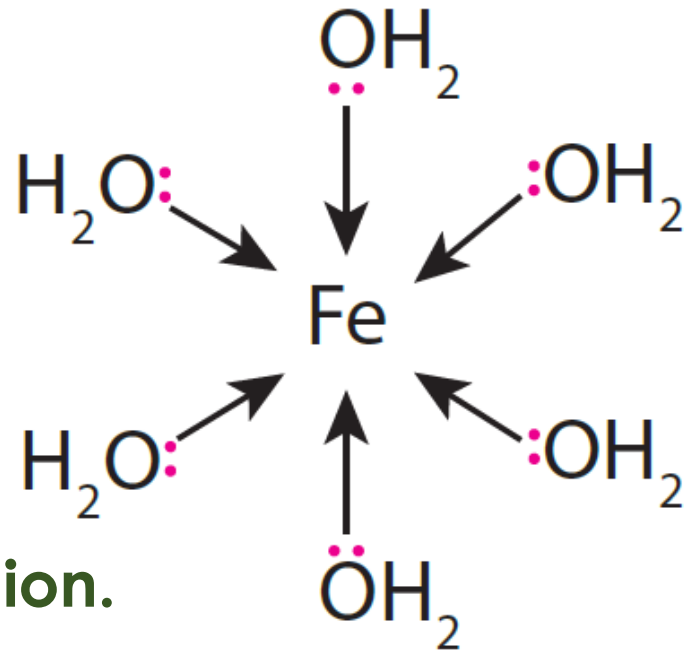
Example: Water (H_2O)

- Ligands are the molecule that donates a pair of electrons.

Characteristics of Transition Elements: 6. Complex Ion Formation

Q. What type of bond is formed between central metal ion and ligands?

Ans.: Coordinate Bond or Dative Bond



Coordination Number:

The number of ligands bonded to central metal ion.

For the above complex ion, the coordination number is 6.

Characteristics of Transition Elements: 6. Complex Ion Formation

Q. What is the coordination number in the following compounds?

- $[Fe(CN)_6]^{4-}$

Ans.: 6

- $[Cu(NH_3)_4(H_2O)_2]^{2+}$

Ans.: 6

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