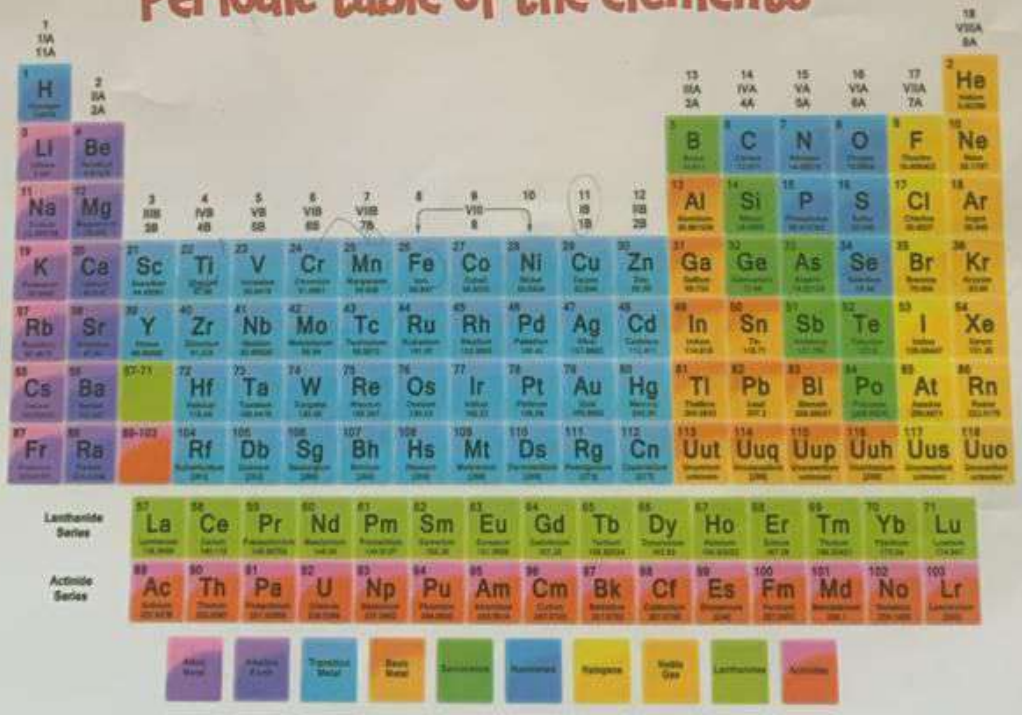
Transition Elements

- We studied in the last year elements of (s) and (p) blocks, which are found on both sides of the long periodic table.
- We will study the transition elements, which occupy the middle of the periodic table between (s), and (p) blocks (representative elements), including more than 60 elements. (More than half of the known elements).

Main Transition Elements

Inner Transition Elements

Periodic table of the elements



The first transition series

Element	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
%Wt	0.0026	0.66	0.02	0.014	0.11	5	0.003	0.0089	0.0068	0.0078

Economic importance and uses

Scandium $_{21}Sc$

- It is found in very small amounts spread on a large area in the earth's crust.
- **Scandium and Aluminum alloy** is light and very hard, so it is used in **MiG fighter jets.** طائرات حربية
- Scandium is added to **Mercury** vapor lamps to produce strong light like sunlight so; it is used in **TV photography at night.**

Titanium $_{22}Ti$

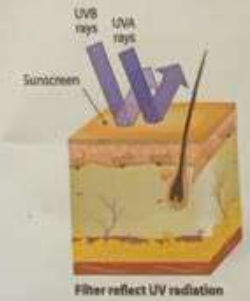
- It is a strong element of rigidity as steel, but less dense. حديد صلب
- **Titanium with Aluminum alloy** is used in **the manufacture of aircrafts and space shuttle.** **Because** it keeps its durability at high temperature.
- Used in **dental implants and artificial joints.** **Because** it is an **inert element** so, the body doesn't reject it and it isn't poisonous.

Important compound

Titanium dioxide (TiO_2):

- Used in **sun protection cosmetics.**

Because its nanoparticles **prevent** the effect of harmful ultraviolet rays on the skin.



Copper $_{29}Cu$

- It is the first discovered metal.
- Copper and tin (Cu+Sn) alloy known as **bronze alloy.**
- Used in coins industry.
- Used in electric cables.
  Because it is good conductor of electricity.

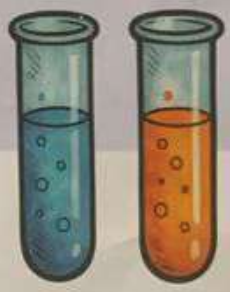
Note

(Cu+Zn) alloy know as **brass alloy.**

Important compound

1. Copper (II) Sulphate ($CuSO_4$):
Used as insecticide and fungicide in the purification of water.

2. Fehling solution: Used to detect glucose (sugar).
Because it's **blue** color changes to **orange.**



Zinc $_{30}Zn$

- Used in galvanization process for other metals.
  Because it protects them from rusting

Important compound

Zinc (II) oxide (ZnO):
Used in paints, rubber and cosmetics.

Zinc (II) sulphide (ZnS):
Used in illuminating paints and x-ray screens

Vanadium $_{23}V$

- Vanadium with steel (ferrovanadium alloy) is used in car springs.
  Because adding a small amount of vanadium to the steel gives its hardness and a great ability to resist corrosion.

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Important compound

Vanadium pentoxide (V_2O_5):

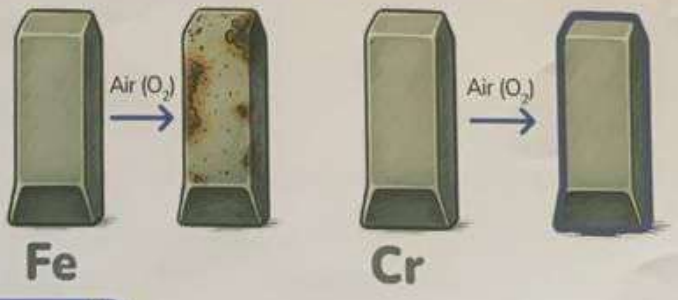
- Used in **dyes for glass and ceramic.**
- used as a **catalyst** in the manufacture of **strong magnetic conductors.**

Chromium $_{24}Cr$

- Used in **leather tanning.**
- Used in **metal painting "plating"**
  Because its chemically active metal
  but it resists the effect of atmospheric air(oxidation-corrosion) due to **"Passivity".**

Passivity

It is the formation of a **non porous** layer of metal oxide, which has larger molecular volume than metal atoms, which prevents further **oxidation (corrosion).**



Important compound

- Chromium (III) oxide (Cr_2O_3): Used in dyes.
- Potassium dichromate ($K_2Cr_2O_7$): Used as an oxidizing agent.

Manganese $_{25}Mn$

- Manganese is **not** used as a pure metal but used as an alloy or a compound.
  Because it is a brittle (هش) metal.
- **Ferromanganese alloy** is used in **railway tracks.**
  Because it is harder than steel.
- **Manganese with aluminum alloy** is used in **soft drink cans.**
  Because it resists corrosion.

Important compound

Manganese dioxide (MnO_2):
as an oxidizing agent in dry cells.

Potassium permanganate ($KMnO_4$):
as an antiseptic substance and oxidizing agent .

Manganese (II) sulphate ($MnSO_4$):
as a fungicide.

Iron $_{26}Fe$

it is the highest in wt %

- Used in reinforced concrete, surgical tools and electricity pylons.
- Used in knifes, guns and cannon pipes.

Used as a catalyst:

1. in the manufacture of **ammonia** by **Haber-Bosch method**
2. in the conversion of **water gas** (mixture of hydrogen and carbon monoxide gases) to a **liquid fuel** by **Fischer-Tropsch method.**

Cobalt $_{27}$Co

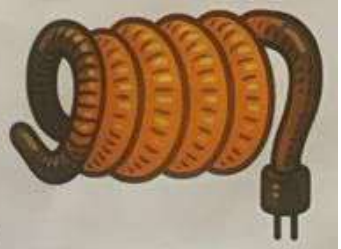
- Used in manufacture of magnets.
  Because it can be magnetized as iron.
- Used in manufacture of modern dry batteries that are used in cars.
- Cobalt has **twelve (12)** radioactive isotopes.

Cobalt $_{60}$ isotope: is the most important isotope used in:

1. Food preservation processes.
2. Detection of the quality of industrial products.
3. Detection of cracks and welding connection.
4. Medicine for diagnosis and treatment of tumors.
   (**Because** it produce **gamma rays**, which have high penetrating power).

Nickel $_{28}$Ni

1. Used in manufacture of rechargeable nickel-cadmium battery.
2. Used in manufacture of vessels which store acids.
   Because it forms alloys with steel that are hard, resist the effect of acids.
3. Nickel and chromium alloy is used in heating coils and electric furnaces.
   Because they **resist corrosion at high temperature.**



4. Used in plating other metals.
   Because it protects them from oxidation and rust, also it gives them beautiful shinny appearance
5. Divided nickel is used as a catalyst in hydrogenation process of oils.