Benha University
Faculty of Science
Chemistry Department

Third year students
Double departments
T.M. Chem. & Coordination Compds

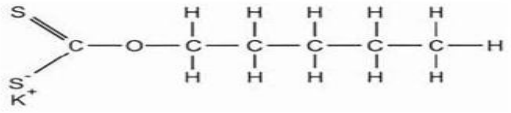
Date : 19.1.2019
Total Time: 2 hour
Time of section B only: 1 hour
Code: Ch323

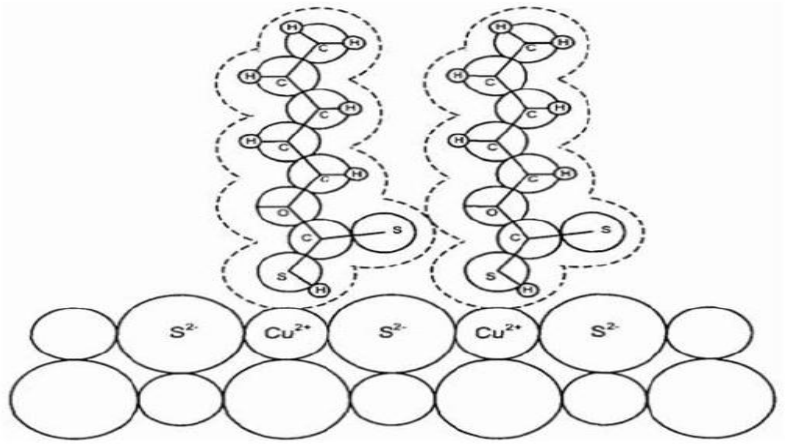
Model answer of section B: [Dr. Ehab Saleh]

1:

Collectors

- Substances that create the water repellent surfaces on copper minerals
- They have a polar (charged) end and non-polar(hydrocarbon) end
- They attach their polar (charged) end to the mineral surface (which is itself polar) leaving the non-polar hydrocarbon end extended outwards
- Example Potassium amyl xanthate





Sketch of attachment of amyl xanthate ions to covellite. There is a hydrogen atom bidden behind each carbon of the hydrocarbon chain

Reactions occured in reverberatory furnace | **Smelting Process**

$$2CuFeS_2 + \frac{13}{4}O_2 \xrightarrow{1350\ ^oC} Cu_2S.\frac{1}{2}FeS + \frac{3}{2}FeO + \frac{5}{2}SO_2$$

Molten matte | First molten slag | Gas

Reactions occured at convertor | **Blister copper production process**

$$2FeS + 3O_2 + SiO_2 \rightarrow 2FeO.SiO_2 + 2SO_2 + heat$$

In molten matte | Second molten slag

$$Cu_2S + O_2 \rightarrow 2Cu + SO_2 + heat$$

In molten matte | Copper blister

2:

Iron rusting or Corrosion of Iron

Corrosion is defined as the chemical **or electrochemical degradation** of **metals** due to their **reaction** with the **environment**. The **corrosion of iron**, better known as **rusting**, is an **oxidation-reduction** process that destroys iron objects left out in open, **moist air**.

Oxidation half-reaction: $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

Reduction half-reaction: $1/2\ O_2(g) + H_2O(l) + 2e^- \rightarrow 2OH^-(aq)$

Overall reaction: $Fe(s) + 1/2\ O_2(g) + H_2O(1) \rightarrow Fe^{2+}(aq) + 2OH^-(aq)$

$Fe^{2+}(aq) + 2OH^-(aq) \rightleftharpoons Fe(OH)_2(s)$

$Fe(OH)_2(s) + 1/4\ O_2(g) + x/4H_2O(I) \rightleftharpoons 1/2Fe_2O_3 \bullet (x+4)H_2O\ (s)$

$Fe(OH)_2\ (s) \rightleftharpoons FeO\ (s) + H_2O(l)$

Also,

Oxidation half-reaction: $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

$$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$$

$$2Fe^{2+}(aq) \rightarrow 2Fe^{3+}(aq) + 2e^-$$

Reduction half-reaction: $1/2\ O_2(g) + H_2O(l) + 2e^- \rightarrow 2OH^-(aq)$

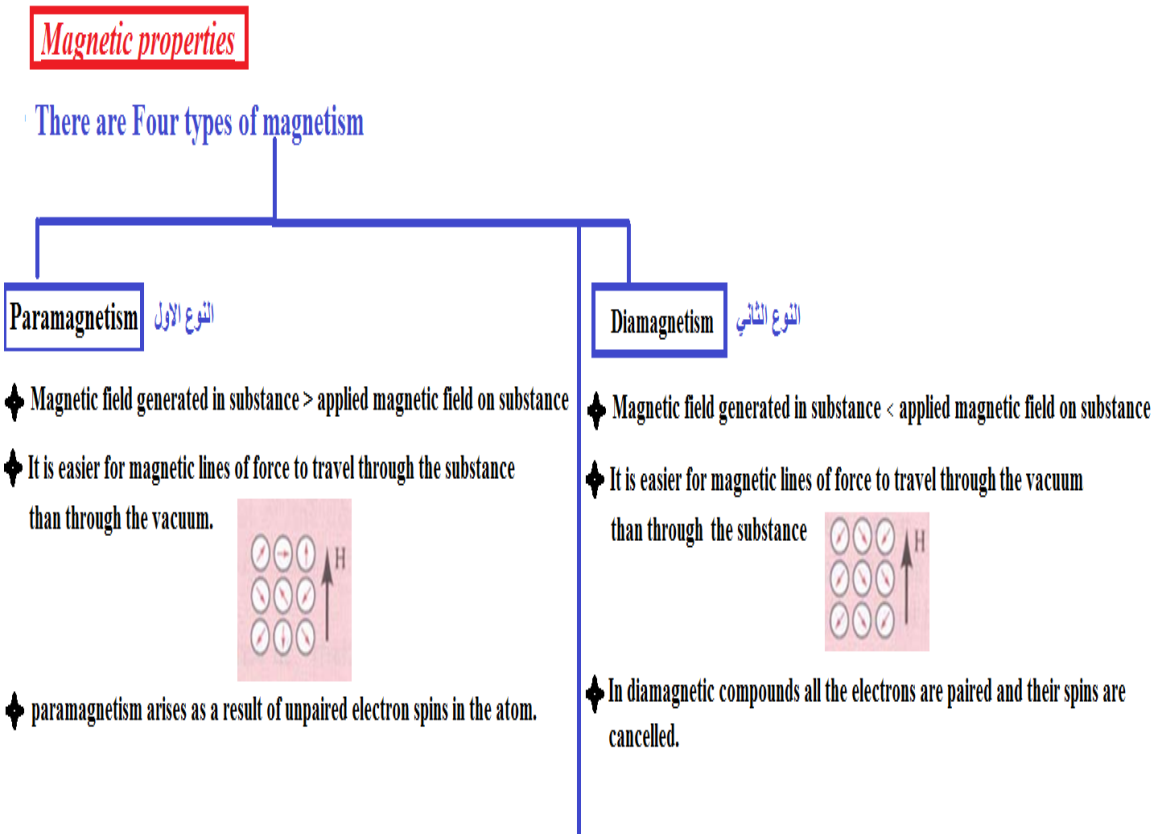
Overall Reaction: $2Fe^{2+}(aq) + 1/2\ O_2(g) + H_2O(l) \rightarrow 2Fe^{3+}(aq) + 2OH^-(aq)$

$$Fe^{3+}(aq) + 3OH^-(aq) \rightleftharpoons Fe(OH)_3(s)$$

$$Fe(OH)_3(s) \rightleftharpoons FeO(OH)\ (s) + H_2O(l)$$

$$2\ FeO(OH)\ (s) \rightleftharpoons Fe_2O_3 + H_2O(l)$$

3:

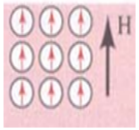


Magnetic properties

There are Four types of magnetism

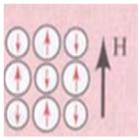
Ferromagnetism النوع الثالث

Ferromagnetism can be regarded as a special case of paramagnetism in which the moments on individual atoms become aligned and all points in the same direction.



Antiferromagnetism النوع الرابع

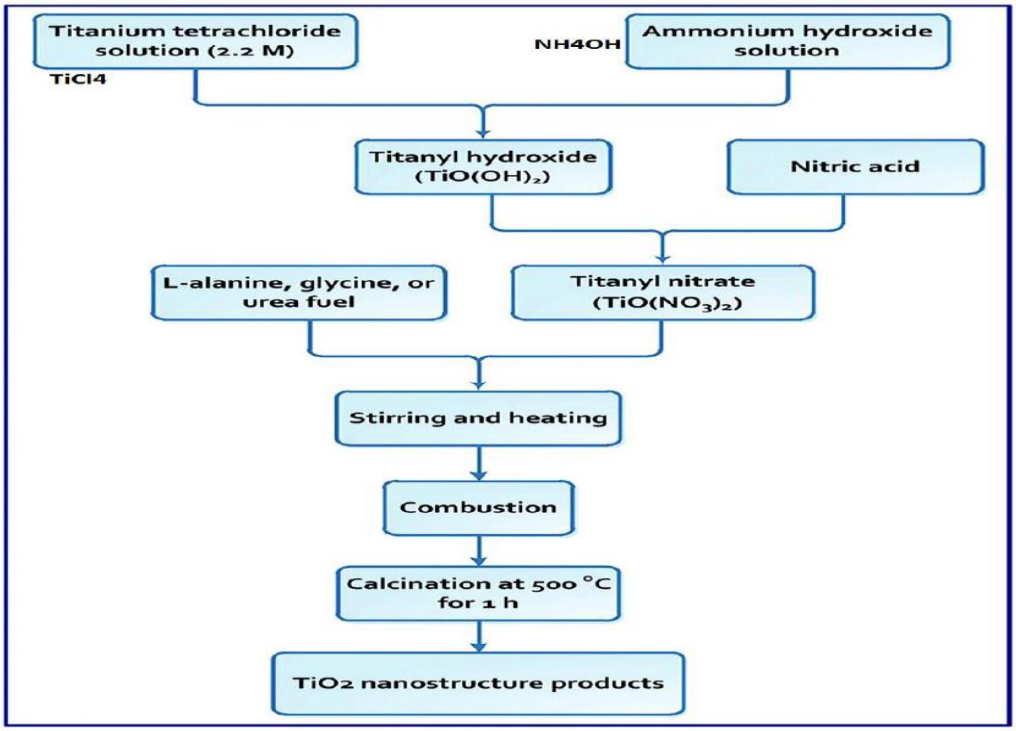
It is also possible to get antiferromagnetism by pairing the moments on adjacent atoms which point in opposite directions. This gives a magnetic moment less than would be expected for an array of independent ions.



4:

Synthesis of titanium dioxide TiO_2:

Combustion method



(a) L-Alanine Fuel:

$$15TiO(NO_3)_2 + 10C_3H_7NO_2 \longrightarrow 15TiO_2 + 20N_2 + 30CO_2 + 35H_2O$$

(b) Glycine Fuel:

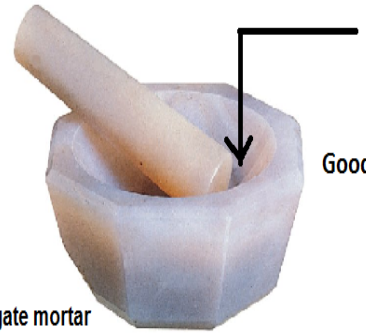
$$15TiO(NO_3)_2 + 10C_3H_7NO_2 \longrightarrow 15TiO_2 + 20N_2 + 30CO_2 + 35H_2O$$

(c) Urea Fuel:

$$6TiO(NO_3)_2 + 10CH_4N_2O \longrightarrow 6TiO_2 + 16N_2 + 10CO_2 + 20H_2O$$

Synthesis of Zinc Orthotitanate (Zn_2TiO_4) nanoparticles by solid state reaction method

Solids do not react together at room temperature over normal time scales and it is necessary to heat them to much higher temperatures in order for the reaction to occur at an appreciable rate.



Agate mortar

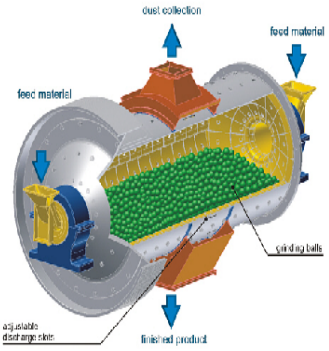
TiO_2: ZnO

1 : 2

Good grinding in the presence of acetone

Calcination at 950 °C for 2 h

Ball Mill



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