Medicinal Chemistry
The first stage
College of Dentistry

By

Assistant Lecturer

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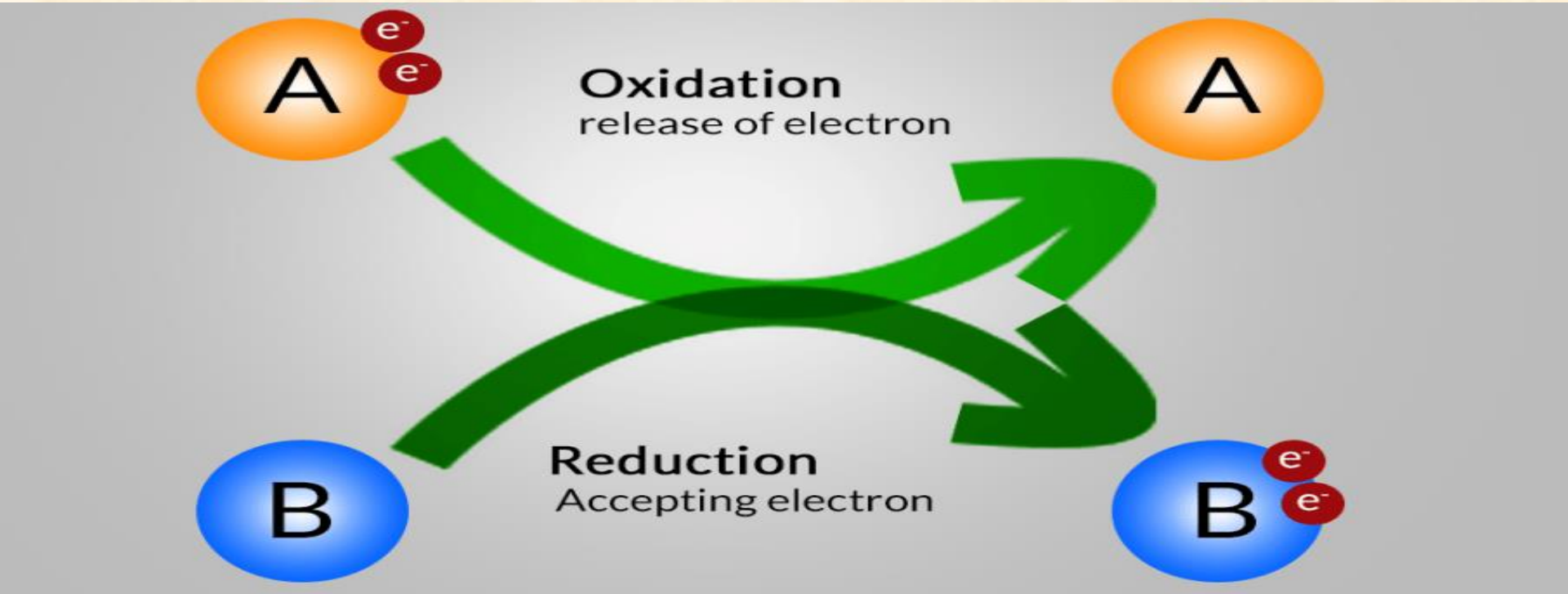
Preparation of different types of solutions

Experiment (9)

Oxidation-Reduction Reactions

1- Oxidation-Reduction Reactions: are all the reactions involving change in oxidation number or transfer of electrons among the reacting substances.

2- Reduction agent: is one that loses electrons and is oxidized to a higher valiancy condition.

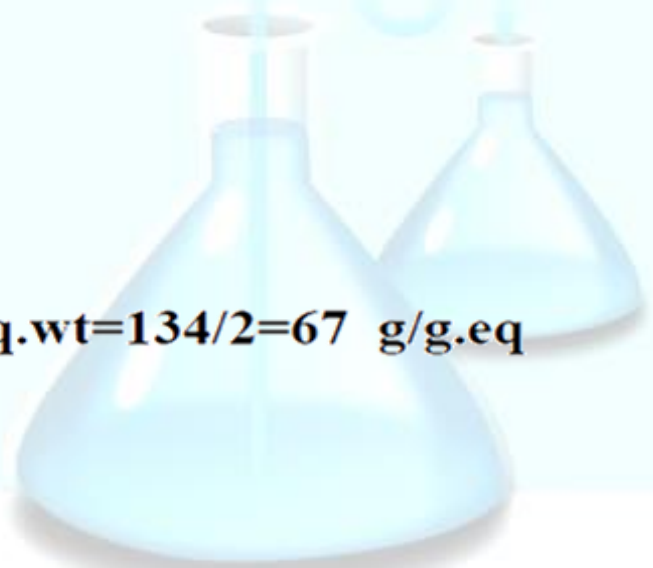


Ex:- Reaction oxalate ion

1) $2C + O_2 = CO_2$ (Fire, Faster process)

2) $4\ Fe + 3O_2 + 6\ H_2O = 2Fe_2O_3.3H_2O$ (Rust, relatively slower process)

3) $C_2O_4^{=} \rightarrow 2CO_2 + 2e^-$ eq.wt=134/2=67 g/g.eq



3- Oxidation agent: is one that gains electrons and is reduced to a lower valiancy condition.

Ex:- Potassium dichromate, potassium permanganate.

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ eq.wt=158.03/5=31.6 g/g.eq

Preparation of Solutions

A: Preparation of 0.1N potassium permanganate ($KMnO_4$).

B: Preparation of 0.1N sodium oxalate ($Na_2C_2O_4$).

$$N = \frac{Wt}{eq.wt} * \frac{1000}{V(mL)}$$

$$0.1 = \frac{Wt}{67} * \frac{1000}{250} \Longrightarrow Wt = 1.675\ gm$$

Standardization of permanganate solution with oxalate ion:

$$N_1 \times V_1 = N_2 \times V_2$$

$$KMnO_4 \quad KMnO_4 = Na_2C_2O_4 \quad Na_2C_2O_4$$

$$(MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O) \times 2$$

$$(C_2O_4^{=} \rightarrow 2CO_2 + 2e^-) \times 5$$

$$2MnO_4^- + 16H^+ + 5C_2O_4^{=} \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$$

Determination the concentration of ferrous ion:

$$V_{KMnO4} \times N_{KMnO4} = \frac{\frac{Wt\ Fe^{2+}}{55.85}}{1000}$$

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

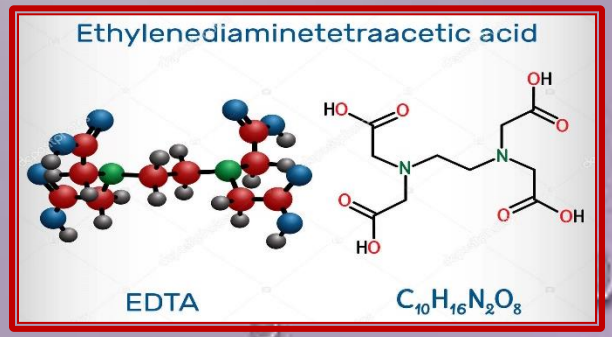
$$(Fe^{2+} \rightarrow Fe^{3+} + e^-) \times 5$$

$$MnO_4^- + 8H^+ + 5\,Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$$

Experiment (10)

COMPLEXOMETRIC TITRATIONS

This kind of titration is called complexometric because it involved formation of complex especially by using the compound EDTA (Ethylene Diamine Tetra Acetic acid) which forms a stable complex with metal ions especially with calcium and magnesium ions.

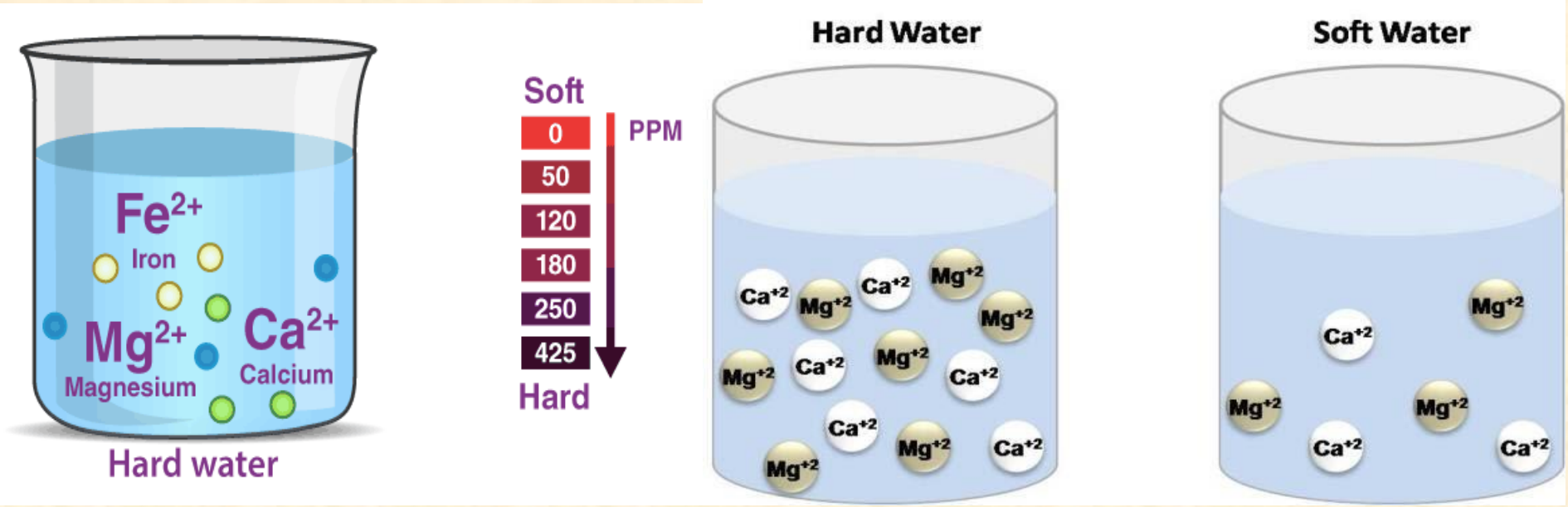


Hardness of Water

The total hardness of water is generally due to dissolved calcium and magnesium salts.

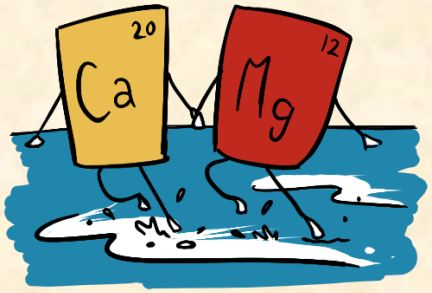
1-Temporary hardness

2-Permanent hardness



Determination of total hardness (permanent and temporary) of water

A: Determination of Total Hardness of Water, For the sample of water (Mg2+ + Ca2+).



Calculations

V_{EDTA}≡ Volume of EDTA which equivalent to ($Mg^{2+} + Ca^{2+}$)⇛ V□A

$N_1 \times V_1 = N_2 \times V_2$

↓ ↓ ↓ ↓

EDTA EDTA Sample(?) Sample

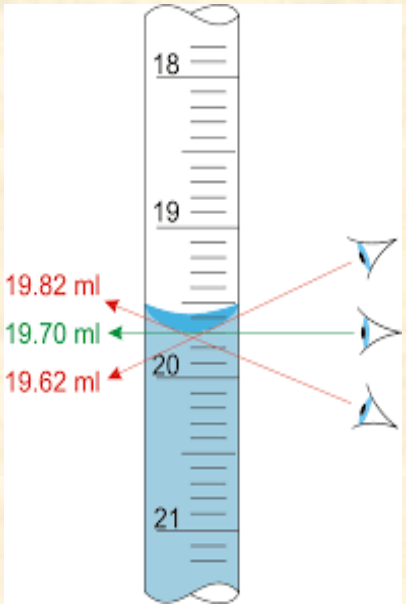
(0.02N)

Total hardness (ppm)=N × eq.wt × 1000

(Concentration of $Mg^{2+} + Ca^{2+}$) $CaCO_3$

Or Total hardness (ppm)=($V_{EDTA}/V_{solution}$)× 2000

(Concentration of $Mg^{2+} + Ca^{2+}$)



B: Determination of the Permanent Hardness

Calculations

V_{EDTA} =Volume of EDTA which equivalent to Ca^{2+} only⇛ V_B

$N_1 \times V_1 = N_2 \times V_2$

↓ ↓ ↓ ↓

EDTA EDTA Sample(?) Sample

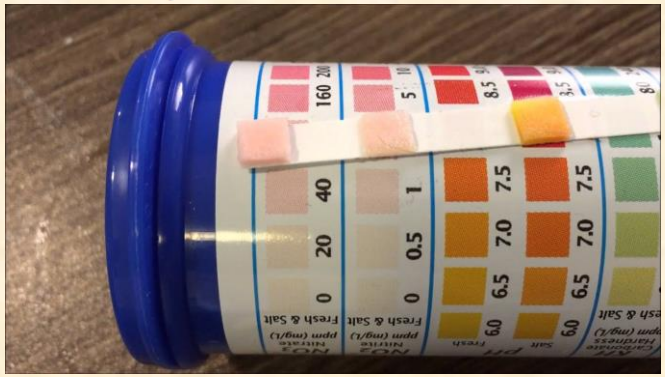
(0.02N)

Permanent hardness (ppm)=N × eq.wt × 1000

(Concentration of Ca^{2+}) $CaCO_3$

Or Permanent hardness (ppm)=($V_{EDTA}/V_{solution}$)× 2000

(Concentration of Ca^{2+})



C: Determination of Temporary Hardness

Temporary hardness = Total hardness – Permanent hardness = $V_A - V_B$

(Mg^{2+}) ($Mg^{2+} + Ca^{2+}$) (Ca^{2+})

$$N_1 \times (V_A - V_B) = N_2 \times V_2$$

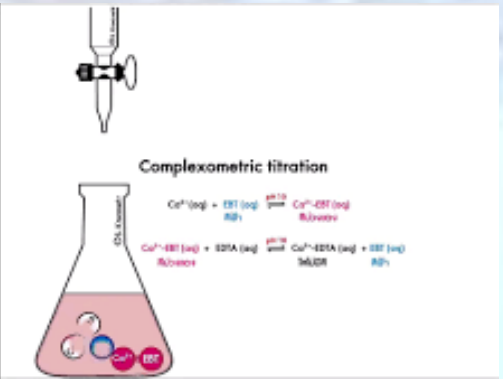
EDTA (0.02N) EDTA Sample(?) Sample

Temporary hardness (ppm) = N × eq.wt × 1000

(Concentration of Mg^{2+}) $CaCO_3$

Or Temporary hardness (ppm) = $(V_{EDTA}/V_{solution}) \times 2000$

(Concentration of Mg^{2+})



Thank You For Listening