PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI

LESSON NOTES

Year/Level: 11 C/D Week 12 **Subject:** Chemistry

Strand	3 Reactions
Sub Strand	3.2 types of reactions
Content Learning Outcome	Distinguish and describe different types of reactions based on chemical statements and balanced chemical equations

OXIDATION-REDUCTION

- Oxidation is the gain of oxygen, so combustion and corrosion reactions are oxidation reactions. Reduction is the loss of oxygen
- Oxidation and reduction reactions occur simultaneously. As a substance is reduced the other reactant will be oxidized
- An **oxidizing agent** gets **reduced** and **reducing agent** gets **oxidised**

Example 1:
In the extraction of metal from metal oxides using carbon, the metal oxide is reduced to the metal and carbon is oxidised to carbon dioxide.

$$C_{(s)} + 2CuO_{(s)} \longrightarrow 2Cu_{(s)} + CO_{2\ (g)}$$

Therefore, copper is a oxidizing agent and carbon is a reducing agent

Example 2:
Iron metal is produced by the reduction of iron (III) oxide by carbon monoxide. The carbon monoxide is oxidised to carbon dioxide.

$$Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(l)} + 3CO_{2(g)}$$

Note:
- The combined term for oxidation-reduction reaction is **REDOX** where one reactant is oxidized and the other is reduced
- Oxidation is the **loss** of **hydrogen or electrons**; Reduction is the **gain** of **hydrogen or electrons**.

Oxidation and Reduction Half-equation

Oxidation(loss of electron)	**Reduction (gain of electron)**
$Mg \longrightarrow Mg^{2+} + 2e^-$	$Mg^{2+} + 2e^- \longrightarrow Mg$
$2O^{2-} \longrightarrow O_2 + 4e^-$	$O_2 + 4e^- \longrightarrow 2O^{2-}$

Example of Oxidation reaction
Ionisation of metal atoms to positive metal ions (cations) is an oxidation reaction as electrons are lost from it valence shell.

$Na \rightarrow Na^{+} + e^{-}$

$Mg \rightarrow Mg^{2+} + 2e^{-}$

$Al \rightarrow Al^{3+} + 3e^{-}$

(Electron(s) lost will appear on the right side of the equation)

Example of Reduction reaction

Non-metals gaining electron(s) to form stable negative ions (anions) are reduction reactions.

$Cl_2 + 2e^{-} \rightarrow 2Cl^{-}$

$O_2 + 4e^{-} \rightarrow 2Cl^{2-}$ (Electron(s) gained will appear on the left side of the equation.)

Note

Displacement Reactions of Metals is an Oxidation and Reduction. The more active metal is oxidised to its ions and the less active metals is reduced from its ionic form (in aqueous solution) to the metal. Eg Iron filings placed in a beaker of copper sulphate solution reduces the copper ions (light blue solution) to copper metal (reddish brown)

$Fe \rightarrow Fe^{2+} + e$ – Oxidation Reaction

$Cu^{2+} + e \rightarrow Cu$ – Reduction Reaction

Displacement Reactions of Active Metals with dilute acid is an Oxidation and Reduction. The more active metal is oxidised to its ions and the hydrogen ions in acid is reduced is hydrogen gas (bubbles evolved)

$Mg \rightarrow Mg^{2+} + e$ – Oxidation Reaction

$2H^{+} + 2e \rightarrow H_2$ – Reduction Reaction

Activity

1.For the following reactions tell which elements are oxidized and which elements are reduced:

a. $4Al + 3O_2 \longrightarrow 2Al_2O_3$

_____

_____

_____

b. $2HgO \longrightarrow 2Hg + O_2$

_____

_____

_____

c. $2KMnO_4 \longrightarrow K_2MnO_2 + O_2$

_____

_____

_____