



SHS LEARNING ACTIVITY

CHEM1-03-05

Name: _____ Score/Mark: _____

Grade and Section: _____ Date: _____

Strand: STEM ABM HUMSS ICT (*TVL Track*)

Type of Activity : Concept Notes Skills: Exercise/Drill Illustration

Laboratory Report Essay/Task Report Other: _____

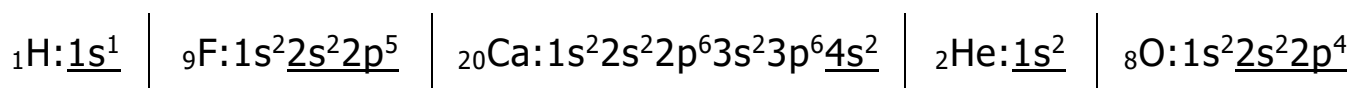
Activity Title: 03-05.Valence electrons and the octet rule v03

Learning Target: To identify the reacting electrons of an elements

Authors/References: Victor Sojo

Elements can have many electrons. For example, neutral silver has 47, and neutral lead has 82. Not all of these are involved in chemical reactions. In fact, **only the outer electrons participate in chemical reactions.**

These are called the **valence electrons**, underlined as follows:



When elements react, they often gain, lose, or share electrons until they end up with a s^2p^6 configuration. This is called a full or "**closed**" shell. The noble gases (He, Ne, Ar, Kr, Xe) do not tend to react at all. This is because they already have a closed shell, which is very stable. For this reason, some like to say that **atoms tend to get the electronic configuration of the closest noble gas.**

Calcium, for example, can **lose** its two valence electrons and form the ion calcium, $\text{Ca}^{2+}: 1s^2 2s^2 2p^6 3s^2 3p^6$, which has the configuration of argon (${}_{18}\text{Ar}$).

Fluorine would instead tend to **gain** one electron and end up as the ion fluoride with the configuration of ${}_{10}\text{Ne}$, $\text{F}^-: 1s^2 \underline{2s^2 2p^6}$. Unsurprisingly, calcium reacts with fluorine, forming calcium fluoride: $\text{Ca} + \text{F}_2 \longrightarrow \text{CaF}_2$

Here, two electrons were transferred from calcium, one to each fluorine.

But sometimes neither element would benefit from losing electrons, so they **share**. Hydrogen would welcome one electron and end up with a helium-like $1s^2$, whereas oxygen would prefer two and have neon's $1s^2 2s^2 2p^6$. The solution? Two hydrogen atoms can each share one electron with one oxygen atom.



Lewis structure of H_2O

In this **Lewis structure**, we normally end up with eight electrons around each atom (except H, which ends up with 2). This is called the **octet rule**.

Exercise: Draw the Lewis structures of H_2 , O_2 and CO_2 .

