



SHS LEARNING ACTIVITY

CHEM1-03-03

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: 03-03.The modern, quantum-mechanics view of the atom v04

Learning Target: To describe the modern understanding of electronic structure based on Quantum Mechanics

Authors/References: Victor Sojo / Brown's Central Science; Wikipedia

Thomson (1897) discovered that atoms have easy-to-move electrons. Then in 1910 Rutherford discovered the nucleus, and suggested a planetary model. In 1919, Rutherford himself discovered protons, positive particles that compose the nucleus, and Chadwick discovered neutrons in 1932.

This painted a full picture of the atomic particles (neutrons and protons in the nucleus, electrons distributed away around the nucleus). But how exactly are electrons distributed around the nucleus?

Many discoveries, hypotheses, discussions and even quarrels have led to our current understanding, based on a theory called **quantum mechanics**. The main contributors have been scientists such as Planck, Einstein, de Broglie, Heisenberg, Schrödinger, Pauli, Hund, and many others.

The theory is very complex, and we cannot go over it in detail here, but we can study some important conclusions of what we know:

- Electrons behave **both** as **particles** (like a ball) and **waves** (like sound).
- Electrons are not in simple 2-dimensional planetary **orbits**, but instead in **3-dimensional "orbitals"**.
- **Orbitals are not like bags** in which electrons are held, but instead they are **volumes** where it is most likely (or **probable**) to find an electron.
- **There cannot be more than 2 electrons in any orbital.**
- Atoms have four main types of orbitals: **s**, **p**, **d**, and **f** (always lowercase).
- **s** orbitals only take **2 electrons**. **p** orbitals are actually **three** separate orbitals, so they take **6 electrons** in total. **d** orbitals are actually **five** separate orbitals, and **f** orbitals are actually **seven**.

Question: How many electrons fit into the d and f groups of orbitals?

