Name: Key

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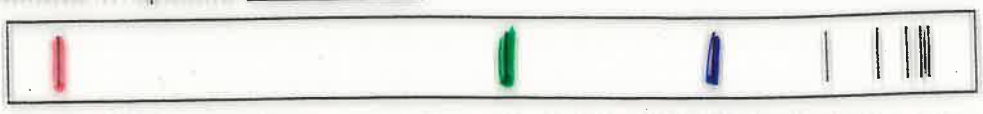
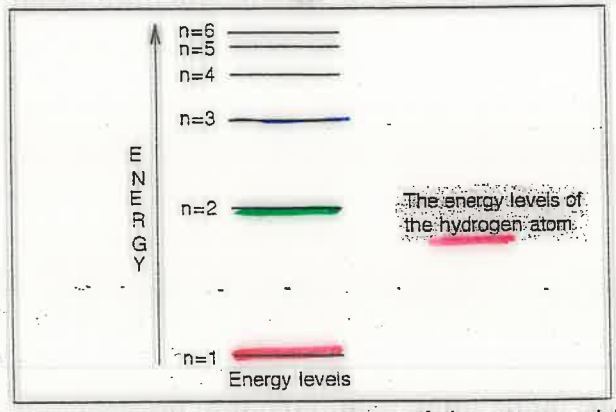
# Chemistry 11
## ENERGY LEVEL DIAGRAM OF THE ATOM

In the early 1900's Neils Bohr conducted many experiments on atoms. In one such experiment, he irradiated the HYDROGEN ATOM with energy and noticed that some of the energy was absorbed and then re-emitted. He passed the re-emitted light through a PRISM and observed a specific line spectrum which he then used to generate his hypothesis about electrons circling the nucleus in specific ORBITS.



As a result of this experiment, scientists started to think that electrons can exist in different ENERGY LEVELS in an atom. And the energy required for an electron to move from one energy level to another was described as a QUANTUM.




Bohr's experiments lead to our present understanding of the atom which is called the QUANTUM MECHANIC MODEL. Unfortunately, Bohr's experimental results were flawed as they dealt with an atom that contains only ONE electron. And subsequent experiments with atoms that contain numerous electrons have generated an updated Energy Level Diagram. Bohr's notion of electrons orbiting a nucleus along a specific path was then replaced by the idea that different electrons, depending on their energies, simply occupy particular regions called ORBITALS.

## THE QUANTUM MECHANIC MODEL OF THE ATOM

Electrons can exits (exist) in different ORBITALS thereby providing the **lowest possible energy** for the atom. In order for this to be accomplished the following rules have been established:

The SHELL is the set of all orbitals having the same "n"-value.

A SUBSHELL is a set of orbitals of the same type.

1, 2, 3 → ∞

s, p, d, f

For any given "n" value there are n different types of possible orbitals

n=1 the s-type

n=2 the s-type + p-type

n=3 the s, p and d-type

n=4 the s, p, d and f-type.

The s – type subshell consists of ONE s-orbital
The p – type subshell consists of THREE p-orbitals
The d – type subshell consists of FIVE d-orbitals
The f – type subshell consists of SEVEN f-orbitals

**ELECTRON CONFIGURATIONS:**

One way to illustrate the Quantum Mechanic Model of the atom is through an electron configuration.

1. Follow the Energy Level Diagram and start from the bottom and work your way up.
2. Write the symbol of the element
3. Write an open bracket
4. Use the atomic number and place a maximum of TWO electrons into each orbital (or dash) until you run out of electrons.
   - 2 in an s-type
   - 6 in an p-type
   - 10 in an d-type
   - 14 in an f-type
5. Write the **maximum** number of electrons as a superscript.
6. When you run out of electrons, finish with a closed bracket.

**Examples:**

a. H ($1s^1$)
b. He ($1s^2$)
c. Be ($1s^2 2s^2$)
d. B ($1s^2 2s^2 2p^1$)
e. C ($1s^2 2s^2 2p^2$)
f. N ($1s^2 2s^2 2p^3$)
g. O ($1s^2 2s^2 2p^4$)
h. F ($1s^2 2s^2 2p^5$)
i. Ne ($1s^2 2s^2 2p^6$)

* Sc ($1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$)

**Homework: Ex 26 (all)**