"Lewis Dot Diagrams"

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I. DCPS Standards:

8.1.5 Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative opinions.

8.2.3 Construct a model of an atom and know that the atom is composed of protons, neutrons, and electrons.

8.2.10 Describe the scientists involved with current atomic theory.

II. Goals:

Students will understand the fundamentals of the electronic structure of light atoms.

III. Objectives:

Students will use Lewis dot diagrams to represent the electronic arrangement of atoms.

Prerequisite Knowledge: The electronic orbitals in an atom (roughly) follow the order 1s/ 2s, 2p/ 3s, 3p/ 4s, 3d, 4p/ 5s, 4d, 5p/ 6s, 4f, 5d, 6p/ 7s, 5f, 6d, 7p. The first full shell consists of the energy level n=1. It contains two electrons. The second full shell consists of the n=2 level. It contains 2x4=8 electrons. However the third full shell consists of only *part* of the n=3 energy level, the 3s and 3p orbitals, again containing 2x4=8 electrons. The 3d orbital is part of the fourth full shell which has 2x9=18 electrons. The remaining shells have 18, 18, and 32 electrons. Due to the Pauli exclusion principle electrons must have different overall wave functions; this allows for exactly one spin-up and one spin-down electron in the same spatial orbital.

For the first three shells we can assume that the electrons in the shell with the same spin orientation have equal energy so that all the spin-down (say) orbitals must be filled before the spin-up ones are. This is represented in a simplified way with the use of dots in a Lewis diagram, which are arranged around the chemical abbreviation for the atom, to represent the valence electrons, i.e. those in an unfilled shell.

IV. Essential Questions:

How do Lewis dot diagrams show the structure of valence electrons?

V. Procedure: The instructor demonstrates the Lewis dot diagrams and then gives the students certain examples to complete.

VI. Evaluation and Assessment: The students should be able to use the dot diagrams to accurately predict the valence electron structure of any of the first 20 elements. This also serves as a useful starting point for the study of ions.