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An introduction to covalent bonding in molecular compounds
Alexi

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Objective: To review and practice covalent bonding of molecular compounds.

Target student audience: YR. 1 GENERAL CHEMISTRY

ChemSense User Level: Intermediate

ChemSense Tools used: DRAWING

Specialized tools needed: None

Classroom implementation:

Time: Short class period (45-55 minutes)

Student grouping: PAIRS, INDIVIDUAL, GROUP

Activity Type: DRAWING

Chemistry Concepts in Activity (linked to CA standards & ChemSense 5 themes):

Standard 2a- Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.

Standard 2b- Students know chemical bonds between atoms in molecules such as H_2 , CH_4 , NH_3 , H_2CCH_2 , N_2 , Cl_2 are covalent.

Standard 2e- Students know how to draw Lewis dot structures.

Prerequisite chemistry concepts: Students will already have a concrete understanding of ionic compounds, and have learned the basic terms and structures regarding molecular compounds. Other topics as prerequisites include: Atomic Model, Periodic Table (including trends), Valence Electrons, and Lewis Dot Structures.

Inquiry skills (linked to NSES):

Identify question and concepts that guide scientific investigations (NSES)

Formulate and revise scientific explanations and models using logic and evidence (NSES)

Communicate and defend a scientific argument (NSES)

ACTIVITY Summary:

1. ChemCatalyst- Make molecules from the atoms given. (ChemSense)
2. Writing activity- Create list of prior knowledge of molecules.
3. Discussion- Compile class information about molecules.
4. ChemRxn- Create molecules and ionic compounds to show their differences. (ChemSense)
5. Check In- Evaluate accuracy of other students' models.

Sources: Chemistry: Visualizing Matter. Holt

Application:

Understanding the composition of matter at a molecular level will enhance understanding of molecular biology and macromolecules (proteins, lipids, carbohydrates, nucleic acids). Submicroscopic knowledge will also enhance understanding of many other physical and life processes.

Activity:

1. ChemCatalyst- Students use ChemSense to review covalent structures. They are given various atoms with corresponding valence electrons. After identifying the atoms they use them to build molecules. They should be able to see where the shared electrons are located by the two black dots. After making the models, students answer the questions: "What bond have you created?" and "How do you know this." Knowing the answers to these questions will allow students to discuss further with the whole group. (5 minutes)
2. Writing Activity-
 - Students write down everything they can think of that they know or think they know when they hear the word "molecule". (5 minutes)
 - Upon finishing, students share their list with a partner to accumulate more information (2 minutes).
 - Class shares individual lists with the group, teacher writes down their list on the board (2 minutes).
 - Teacher adds to the lists or organizes information as needed. Then teacher compares what they previously had learned about ionic compounds to molecules. (10 minutes)
3. ChemRxn- Students use ChemSense, in pairs, to show the differences (submicroscopic) between ionic and molecular compounds. They are able to use whatever tools they need to create the compounds. When finished, students publish their ideas of their compounds. (15 minutes)

4. Check In- For homework or at the end of class, students check out the other students' compounds and evaluate them for accuracy. They will bring an evaluation of the others' diagrams to class the following day to discuss with the whole group.

Rubric/s for scoring:

Level:	Defining characteristics:
Insufficient mastery	Differences between covalent and ionic bonds are not shown properly.
Basic mastery	Bonds are shown differently between ionic and covalent bonds, but some concepts are forgotten (ionic-lattice structure vs. molecular unit).
Exemplary mastery	Covalent bonding is shown accurately in all molecules. Ionic compounds are correctly shown as electrostatic interactions between atoms. Ionic compounds are shown as lattice structures, while molecules are represented as discrete units.