

Ion Polarization Lesson Plan

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Content Area: Chemistry	Grade Level(s): 10th Grade

Lesson Content

Background Information/ Relevance/ Context/ Rationale (Purpose):

This lesson will come after we have covered information on ion charges, ionic bonding, and have started talking about covalent bonds. This lesson will cover parts of polar and nonpolar covalent bonds, and how that affects how molecules interact with different ends of those partial charges.

NGSS Addressed:

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Construct an explanation for why and how (SEP-6) the transfer of electrons causes the formation (CCC-2) of ionic bonds through the electrical forces between atoms leading to new properties (PS1.A).

Construct an explanation for how (SEP-6) atoms share electrons to cause the formation (CCC-2) of covalent bonds which then determines the structure and properties of the matter at the bulk scale. (PS1.A)

Construct an explanation for how (SEP-6) atoms share or give/take electrons to cause the formation (CCC-2) of different bonds based on the types of compounds present, which then determines the structure and properties of the matter at the bulk scale. (PS1.A)

Learning Targets

As a result of this unit, students will...

Explore the following ESSENTIAL QUESTIONS... How do atoms bond with each other?	UNDERSTAND THAT... Atoms bond and interact in different ways depending on their properties.
KNOW... Charges of common ions formed based on location on the periodic table. It is most stable for an atom to have access to 8 valence electrons In an ionic bond, electrons are transferred. In a covalent bond, electrons are shared.	BE ABLE TO (DO)... Predict bonding behavior based on the elements given, using the periodic table. Convert from molecular name to formula and visa versa. Identify if two compounds will form ionic, polar covalent, or nonpolar covalent bonds. Create a Lewis Dot Structure of a covalent compound

Lesson Sequence

Steps in the Lesson (including Timing and Modalities & Resources Utilized)

Day 1+:

- Doesn't reference lab or research materials, but these days are covering covalent bonds. Focuses are on nomenclature, molecular formula, lewis dot structures, and covalent bond behavior

Research Day Lesson Plan:

- Start with a charge bellringer, to review that concept. The question would be something along the lines of, "why do atoms have charges?" (stability) or "create a metaphor for the bonding behavior of covalent bonds" (i.e., tug rope)
- Go over electronegativity and describe it as strength of an atom to hold onto electrons
- Talk about water specifically, using a real world model. Maybe tug of war to describe how oxygen will hold the electrons closer to it.
- Predict - ask the students to predict how this behavior of water will affect the charge of it. Have them draw and ideate with their classmates for visualization purposes
 - Hopefully they get to the idea that water has partial charges
- Describe this as partial charges, and polarity
- Now predict - how would water interact with two different ions - Cl^- Na^+
- Introduce research and computer simulation.
- Show NaCl simulation of this exact phenomenon to confirm or deny their theories.
- Ask students to revise their explanation above with the new information

- Spend time discussing the technology behind the simulation and the necessary steps to refine simulations to make them more accessible
 - Allow students to create ideas of how to make the simulation better
 - Could be difficult because the students don't know the possible refinements that can be done in VMD

Extension Activity:

- Ask high achieving students to take this knowledge and describe why ionic compounds dissolve in water

Day(s) after:

- Give Covalent Bonding Quiz to assess understanding, and identify any gaps in knowledge.

Materials/ Supplies/ Sources/ Digital and Interactive Instructional Technology (if appropriate):

Lewis Dot Structure Practice

Covalent Bonding Quiz

nacl.psf & nacl.dcd molecular simulation, opened with VMD

NaCl.gif series for easy visualization

LEWIS STRUCTURE PRACTICE

Draw the Lewis Dot Structure for the following compounds, and identify if they are polar or non-polar

1) SCl_2

2) AsF_3

3) SiH_4

4) CHF_3

5) HBr

6) Cl_2O

7) HC_2Cl

8) N_2F_2

9) HCN

10) CH_2Br_2

11) C_2F_2

12) PCl_3

13) SF_2

14) CO

Covalent Bonding Quiz

1. Describe any **two** differences between ionic and covalent bonding.

2. Name the following covalent compounds

1. N_2O

2. CS

3. S_4N_4

3. Give the chemical formula for the following covalent compounds

1. Silicon disulfide

2. Iodine monochloride

3. Dinitrogen tetroxide

4. Give the chemical formula **or** name for the following **ionic** compounds

1. Calcium bromide

2. Barium nitrate

3. $(\text{NH}_4)_3\text{PO}_4$

4. FeO

5. Draw the Lewis Dot Structure for the following covalent compounds, and identify if they are polar or nonpolar

a. CCl_4

b. HF

c. CO_2