# Unit 6 - Chemical Bonding, Formulas & Naming

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **20 days**
Status: **Published**

## Summary

Chemical bonds are the forces that bind atoms of elements together to form molecules and compounds. The difference between the bonds are related to the types of elements and the sharing of electrons between them. Students will investigate ionic bonds, covalent bonds, metallic bonds and the intermolecular forces that attract individual molecules together. This includes hydrogen bonds which are not chemical bonds but new research suggests that maybe they sometimes kind of are. Students will use their knowledge of chemical bonding to predict the shape of simple molecules and how this affects the forces between molecules and how the substance behaves. The periodic table will now be used to predict the type of bond that will form between atoms and even what atoms will gain, lose, or share the electrons necessary to form the bond itself. It will even be used to develop the unique names of the compounds.

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| P.3 | Consider the environmental, social and economic impacts of decisions. |
| P.4 | Demonstrate creativity and innovation. |
| P.5 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| 9.4.12.CT | Critical Thinking and Problem-solving |
| P.8 | Use technology to enhance productivity increase collaboration and communicate effectively. |
| P.9 | Work productively in teams while using cultural/global competence. |
| MA.N-Q.A.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| MA.N-Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| MA.N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| LA.RST.11-12.1 | Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. |
| 9.4.12.GCA | Global and Cultural Awareness |
| 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. |
| 9.4.12.IML | Information and Media Literacy |
| LA.WHST.11-12.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. |
| 9.4.12.TL | Technology Literacy |
| LA.WHST.9-10.7 | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LA.WHST.9-10.8 | Gather relevant information from multiple authoritative print and digital sources, using |

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| | advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| LA.WHST.9-10.9 | Draw evidence from informational texts to support analysis, reflection, and research. |
| HS-PS2-6 | Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. |
| HS-PS3-5 | Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. |

## Essential Questions/Enduring Understandings

## Essential Questions

- How do atoms interact to form the substances in the world around us?
- What is the link between the macroscale properties of substances we observe and the intermolecular forces within the substance itself?

## Enduring Understandings

- The properties of substances we can observe and measure are linked to the type of chemical bond and presence of intermolecular forces between the substances particles (atoms or molecules).
- The systematic nomenclature of compounds ensures that each structure results in a unique name.

## Objectives

## Students Will Know

- Students will know the four types of chemical bonds (ionic, polar covalent, nonpolar covalent, metallic) and be skilled at identifying them based off specific properties.
- Students will know the octet rule and be skilled at applying VSEPR theory when describing the 3 dimensional structure of water and other small molecules.
- Students will know the difference between a chemical bond and an intermolecular force.

## Students Will Be Skilled At

- Students will be skilled at the four types of chemical bonds using electronegativity and the octet rule (ionic, polar covalent, nonpolar covalent, metallic).
- Students will be skilled at utilizing the ionic compound and binary molecular compound naming systems.
- Students will be skilled at drawing simple Lewis structures to represent the arrangement of atoms, electrons, and bonds in simple molecules.
- Students will be skilled at naming binary molecular compounds, binary ionic and tertiary (polyatomic) ionic compounds when given the formula or develop the formula from the name.

## Learning Plan

- Preview essential questions and connect them to the concepts we will cover in the unit.
- Compare and contrast the four types of chemical bonds by descriptions of compounds (formulas and properties).
- Describe the formation of the four types of chemical bonds using electronegativity and the octet rule.
- Investigate unknown samples in order to determine the type of chemical bonds the material is composed of.
- Apply the octet rule in the drawing of Lewis structure for individual atoms and then simple molecules. Investigate VSEPR theory by developing 3D molecular models of simple molecules.
- Differentiate between chemical bonds and intermolecular forces and link the presence of them to the sharing of electrons and 3D shape of the molecule.
- Name ionic compounds when given the formula or develop the formula from the name (“A Chemical Jigsaw” or “Chemical Matchmakers”)
- Name binary and tertiary (polyatomic) molecular/ionic compounds when given the formula or develop the formula from the name (“Chemical Matchmakers” Game”)

## Assessment

## Formative Assessment

- Do Now Questions
- Exit Ticket Questions
- Whole Class Discussion Participation
- Small Group Discussion Participation
- Individual Student Questions/Responses
- Independent Tasks

    - Determine the type of chemical bond based on the type of atoms bonding.
    - Observe and describe the affect bond types and intermolecular forces have on the basic properties of a substance.
    - Apply the octet rule and draw correct Lewis structures for individual atoms and molecules.
    - Develop chemical formulas for a compound given its name and develop the name given its formula (for ionic and molecular compounds).
- Lab Experiments

## Summative Assessment

- Unit Quizzes
- Unit Tests
- Lab Reports

## Benchmark Assessment

- CP Chemistry Midterm exam

## Alternative Assessment

- Maximize the possible formulas/names while playing “A Chemical Jigsaw” or “Chemical Matchmaker” games.
- Utilize molecular models and VSEPR theory to identify 3D shapes and the potential intermolecular force the molecule can have.
- Utilize knowledge of bonds, forces, and properties to identify bond types in a laboratory setting.

## Materials

- SAVVAS Experience Chemistry 2021 Textbook Volumes 1 & 2
- Guided notes
- Teacher handouts
- Supplementary worksheets
- Lab Handouts (Bond Identification Lab, Molecular Modeling Activity NOTE: Supplies for each lab included on handout.)
- Chemical Jigsaw and Chemical Matchmakers (labeled pieces or cards)
- Simulations:

    - “Collisions” [https://app.playmada.com/Collisions/] Covalent Bonding, Ionic Bonding, IMFs (students build compounds and explore strength of IMFs; Ions is probably relevant and useful too)
    - “Build a Molecule” [https://phet.colorado.edu/en/simulation/build-a-molecule]
    - “Molecule Shapes: Basics” [https://phet.colorado.edu/en/simulation/molecule-shapes-basics]
    - “Molecule Shapes” [https://phet.colorado.edu/en/simulation/molecule-shapes]
    - “Molecular Polarity” [https://phet.colorado.edu/en/simulation/molecule-polarity]
    - "Matchmaker: Ionic Bonding" Game [https://interactivechemistry.org/Matchmaker/]
    - "Matchmaker: Covalent Bonding" Game [https://interactivechemistry.org/2-DMolecularModels/]
- Safety Supplies (specifics to when they are required included in lab handouts)

## Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504s

https://docs.google.com/spreadsheets/d/1mfe42JCam4Rlgd626vidMg54nDZ1ic055qKKGLvhcPg/edit?usp=sharing