

# CCPS Science Unit Plan

<b>Grade</b>	9-12	<b>Subject</b>	HS Physical Science	<b>Unit #</b>	2
<b>Unit Name</b>	Atoms, the Periodic Table, and Bonding		<b>Timeline</b>	2.5 weeks	
<b>How to use the Framework</b>	<p style="color: red;">This Framework should be used to implement daily science instruction. The resources and instructional strategies reflected in the Framework will provide a foundation for effective implementation and student mastery of standards.</p> <p style="color: red;">Please see the hyperlinked <a href="#">abbreviation document</a> to ensure understanding of all abbreviations used with this framework.</p>				
Unit Overview	<p>This unit is based on the understanding that all matter is made of atoms and atomic structure determines an element's reactivity. This unit ties together atomic structure, periodic table trends, and chemical bonding. The periodic table organizes elements according to similar properties so students can tell the characteristics of an element by looking at its position on the table. It allows students to look up facts and figures for each element, a quick glance at the table reveals a lot about the reactivity of an element, whether it is likely to conduct electricity, whether it is hard or soft, and many other characteristics. Students can predict likely chemical reactivity and formulas.</p>				
<b>Lesson Plan guidance document and template</b>	<p><a href="#">CCPS Lesson Plan Template Day View</a>  <a href="#">Lesson Plan Template Week View</a>  <a href="#">Department of Science Guidance Document</a></p>				
<b>3Dimensional Instruction</b>	<u>GSE</u>	<u>Science and Engineering Practices</u>	<u>Crosscutting Concepts</u>		
	<p><b>SPS1. Obtain, evaluate, and communicate information from the Periodic Table to explain the relative properties of elements based on patterns of atomic structure.</b></p> <p><b>SPS2. Obtain, evaluate, and communicate information to explain how atoms bond to form stable compounds.</b></p> <p><b>SPS1.</b>  a. Develop and use models to compare and contrast the structure of atoms, ions and isotopes.</p>	<p>Asking questions and defining problems</p> <p>Developing and using models</p> <p>Planning and carrying out investigations</p> <p>Analyzing and interpreting data</p> <p>Using mathematics and computational thinking</p> <p>Constructing explanations and designing solutions</p>	<p>Patterns</p> <p>Cause and Effect</p> <p>Scale, Proportion and Quantity</p> <p>Systems and System Models</p> <p>Energy and Matter</p> <p>Structure and Function</p> <p>Stability and Change</p>		

(*Clarification statement:* Properties include atomic number, atomic mass and the location and charge of subatomic particles.)

b. Analyze and interpret data to determine trends of the following:

- Number of valence electrons
- Types of ions formed by main group elements
- Location and properties of metals, nonmetals, and metalloids
- Phases at room temperature

c. Use the Periodic Table as a model to predict the above properties of main group elements.

**SPS2.**

a. Analyze and interpret data to predict properties of ionic and covalent compounds.

(*Clarification statement:* Properties are limited to types of bonds formed, elemental composition, melting point, boiling point, and conductivity.)

b. Develop and use models to predict formulas for stable, binary ionic compounds based on balance of charges.

c. Use the International Union of Pure and Applied Chemistry (IUPAC) nomenclature for translating between chemical names and chemical formulas.

(*Clarification statement:* Limited to binary covalent and binary ionic, containing main group elements, compounds but excludes polyatomic ions.)

Engaging in argument from evidence

**Weekly Lesson Tasks**

**Week 1**

**GSE: SPS1.**

a. Develop and use models to compare and contrast the structure of atoms, ions and isotopes.

(*Clarification statement:* Properties include atomic number, atomic mass and the location and charge of subatomic particles.)

b. Analyze and interpret data to determine trends of the following:

- Number of valence electrons
- Types of ions formed by main group elements
- Location and properties of metals, nonmetals, and metalloids

**Focused Concept:** The Periodic Table, Atoms, Ions and Isotopes

**Phenomenon:** Making salt (sodium chloride):  
<https://goo.gl/LODHSo>

**DQ:** What is the difference in structure between atoms, ions and isotopes?

**SEP:**

- Ask Questions.
- Develop and Use Models.
- Plan and Carry out Investigations.
- Analyze and Interpret Data.
- Obtain, Evaluate, and Communicate Information.

**CCC:**

- Cause and Effect
- Structure and Function
- Patterns

	<b>Day 1</b>	<b>Day 2</b>	<b>Day 3</b>	<b>Day 4</b>	<b>Day 5</b>
<b>Learning Targets</b>	SWBAT identify the number of each subatomic particle for various elements.	SWBAT identify the relationship between group numbers and valence electrons.	SWBAT identify types of ions formed by main group elements.	SWBAT identify how various isotopes are formed.	SWBAT distinguish between metals and nonmetals.

<p><b>Opening</b></p>	<p>Introduce the Periodic Table of Elements with this <a href="#">video</a></p> <p>Teacher Actions: Teacher pauses and discusses key points from the video. Teacher ask probing questions such as, “What will you learn in this lesson? What are some key points from the video?”</p> <p>Student Actions: Students will complete see, think, wonder</p>	<p>Introduce the Element Builder Gizmo by completing page 1 of the Student Handout as a class.</p> <p>The teacher will read through the questions and model how the Gizmo functions.</p> <p>The students will follow along, respond to teacher questioning and fill in page 1 of the Gizmo handout.</p>	<p>Introduce Ions with this <a href="#">video</a></p> <p>Key Video Concepts: If an atom gains an electron it is positive (cation). If an atom loses an electron it is negative (anion).</p> <p>Show this <a href="#">video</a> on the types of ions formed by main group elements.</p> <p>Teacher Actions: Teacher pauses and discusses key points from the videos. Teacher ask probing questions such as, “What will you learn in this lesson? What are some key points from the video?”</p> <p>Student Actions: Students will complete a KWL chart while watching the videos</p>	<p><b>Inspire Physical Science Module 16: Lesson 2: Masses of Atoms</b></p> <p>Go through the Teacher PowerPoint: Masses of Atoms for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p> <p>Have students access the Isotopes Gizmo. Complete page 1 of the student exploration sheet as a class.</p> <p>The teacher will read through the questions and model how the Gizmo functions.</p> <p>The students will follow along, respond to teacher questioning and fill in page 1 of the Gizmo handout.</p>	<p><b>Inspire Physical Science Module 17: Lesson 1: Metals</b></p> <p>Engage: Launch the Lesson: Metals (Online Textbook Resource)</p> <p>Go through the Teacher PowerPoint: Metals for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p> <p><b>Inspire Physical Science Module 17: Lesson 2: Nonmetals</b></p> <p>Engage: Launch the Lesson: Nonmetals (Online Textbook Resource)</p> <p>Go through the Teacher PowerPoint: Nonmetals for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p>
<p><b>Guided Practice/ Transition</b></p>	<p>Show this <a href="#">video</a> on how to read a square on the periodic table and allow students to calculate the number of protons, neutrons and electrons of a given element.</p> <p>Teacher action(s): -Teacher pauses and discusses key points from the video. -Teacher provide a <a href="#">periodic table</a> and coloring</p>	<p>In Pairs, allow students to collaborate and work on Activity B of the Element Builder Gizmo. Allow them to do a question, then share out and repeat until Activity B is complete.</p>	<p>Introduce the “<a href="#">Build an Atom Phet</a>” and its basic functions. Have students build a neutral atom of Lithium and look at the net charge. Next add an electron to Lithium and review the net charge. Continue adding and subtracting electrons to observe how they affect the overall net charge.</p> <p>Have students glue a</p>	<p>In pairs, students should complete Activity A questions 1 - 3. After a few minutes, review these questions and address misconceptions.</p>	<p>In groups, students should complete Reinforcement: Metals from the textbook.</p> <p>In pairs, students should complete textbook resource Reading Essentials: Nonmetals</p> <p>Phenomenon Check: How would you classify the elements that make salt (NaCl)?</p>

	<p>tools</p> <p>Student Action(s): -Students will color code the periodic table and take notes regarding key points/characteristics of elements in each family.</p> <p>Phenomenon Connection: Show students NaCl and how both of those elements can be found on the Periodic Table of Elements.</p>		<p><a href="#">periodic table of elements</a> into their notebooks and label the ion charges for main group elements.</p> <p>You can pause this <a href="#">video</a> at 1:05 to show the types of ions formed by main group elements.</p> <p>*Students will NEED this information later when they are looking at ionic bonding.</p> <p>Phenomenon Connection: What are the types of ions formed by Na and Cl?</p>		
<b>Independent Practice</b>	<p>Have students practice calculating the number of protons, neutrons and electrons (limit the selection to elements 1 - 20).</p> <p>Consider using this <a href="#">worksheet</a> or this <a href="#">virtual activity</a>.</p>	<p>Students complete the Extension activity of the Element Builder Gizmo.</p>	<p>Have students use the simulation and complete this <a href="#">activity</a>.</p>	<p>Independently students complete the chart with question 4.</p>	<p>Textbook Resource: Lesson Check: Metals</p> <p>Textbook Resource: Lesson Check: Nonmetals</p>
<b>Assessment Summary</b>	<p>Cloze Activity: Helium is the second _____ listed on the Periodic Table of Elements. Helium has 2 protons which have a _____ charge, 2 electrons which have a _____ charge and 2 neutrons which have a _____ charge.</p>	<p>TOTD: What is the relationship between the group an element is in and its number of valence electrons?</p> <p>*The number in the ones place of a group number represents the number of valence electrons (excluding transition metals). For example, group 1 has 1 valence electron and group 17 has 7 valence electrons.</p>	<p>Review the post lab activity (questions 12 and 13) whole class.</p>	<p>Review the chart from Activity A question 4 and allow students to share their thoughts.</p>	<p>Go over the lesson checks for metals and nonmetals.</p>
<b>Small Group Tasks</b>					

(TBA)					
<b>Teacher Notes</b>	<p>The textbook introduces atoms and discusses quarks. Quarks are not part of our standards. Therefore, limit instruction to elements, atoms, protons, neutrons and electrons.</p> <p>Great information to know, especially for new teachers that are not sure of how much they should be teaching!</p> <p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p>We are skipping activity A, because we will come back to this concept on a separate day when we teach isotopes.</p> <p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p>Allow students to adjust the electrons in the simulation and observe the resulting net charge. If a student asks about adjusting neutrons - that is an isotope which will be discussed Thursday.</p> <p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p>Do not have students do all tasks associated with this Gizmo or the quiz. This task includes Half Life which we will study when we study nuclear decay.</p> <p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>

## Week 2

### GSE: SPS1.

b. Analyze and interpret data to determine trends of the following:

- Number of valence electrons
- Types of ions formed by main group elements
- Location and properties of metals, nonmetals, and metalloids
- Phases at room temperature

c. Use the Periodic Table as a model to predict the above properties of main group elements.

### SPS2.

a. Analyze and interpret data to predict properties of ionic and covalent compounds.  
*(Clarification statement: Properties are limited to types of bonds formed, elemental*

### Focused Concept:

Metals, Nonmetals and Metalloids

Ionic and Covalent Bonding

Periodic Trends

composition, melting point, boiling point, and conductivity.)  
 b. Develop and use models to predict formulas for stable, binary ionic compounds based on balance of charges.

**Phenomenon:** Making salt (sodium chloride):  
<https://goo.gl/LODHSo>

**DQ:** What are the similarities and differences between metals, nonmetals and metalloids?  
 Ionic and Covalent Bonding, Periodic Trends

- SEP:**
- Ask Questions.
  - Develop and Use Models.
  - Plan and Carry out Investigations.
  - Analyze and Interpret Data.
  - Obtain, Evaluate, and Communicate Information.

- CCC:**
- Cause and Effect
  - Systems and System Models
  - Stability and Change
  - Patterns

	Day 6	Day 7	Day 8	Day 9	Day 10
<b>Learning Targets</b>	SWBAT summarize traits for metals, nonmetals, metalloids, atoms, ions and isotopes.	SWBAT identify types of bonds formed by main group elements.	SWBAT construct and explain the formation of ionic bonds.	SWBAT construct and explain the formation of covalent bonds.	SWBAT construct their own periodic table based on traits of given elements.
<b>Opening</b>	<p><b>Inspire Physical Science Module 17: Lesson 3: Metalloids</b></p> <p>Engage: Launch the Lesson: Mixed Groups (Online Textbook Resource)</p> <p>Go through the Teacher PowerPoint: Mixed Groups for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p>	<p><b>Inspire Physical Science Module 18: Lesson 2: Types of Bonds</b></p> <p>Go through the Teacher PowerPoint: Types of Bonds for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p>	<p>Introduce the Ionic Bonds Gizmo and Complete page 1 of the Student Exploration Sheet as a Whole Class.</p> <p>The teacher will read through the questions and model how the Gizmo functions.</p> <p>The students will follow along, respond to teacher questioning and fill in page 1 of the Gizmo handout.</p>	<p>Introduce the Covalent Bonds Gizmo and Complete page 1 of the Student Exploration Sheet as a Whole Class.</p> <p>The teacher will read through the questions and model how the Gizmo functions.</p> <p>The students will follow along, respond to teacher questioning and fill in page 1 of the Gizmo handout.</p>	<p>Introduce page 1 of the “<a href="#">Pondering the Periodic Table</a>” task from GaDoe</p> <p><a href="#">*Task Answer Key</a></p> <p>Inform students that up to this point we have looked at periodic trends such as those found in subatomic particles, metals, nonmetals and metalloids, groups/families, ions, etc.</p>
<b>Guided Practice/Transition</b>	Jigsaw - put students in groups where they summarize their assigned	In pairs, students should complete Reinforcement: Types of Bonds from the	In pairs, have students complete Activity A. At the end of 10 - 15 minutes	In pairs, have students complete Activity A. At the end of 10 - 15 minutes	In groups, cut out the element cards and arrange them like a periodic table

	topic on chart paper Topics Include: atoms, ions, isotopes, metals, nonmetals and metalloids	textbook.	check to ensure understanding.	check to ensure understanding.	based on properties. Try to place the unknowns in the correct locations based on properties and identify them. This is the “procedure” part of the task
<b>Independent Practice</b>	Students do a gallery walk of each others work where they must add one piece of scientific information to each piece of chart paper. This could be additional facts, examples, etc.  If time permits, allow the students to share out after the Gallery Walk. Engage in class discussion.	Independently, students should complete the following task:  Textbook Resources: SmartBook: Types of Bonds	Independently, have students complete activity B from the Gizmo	In pairs, students can complete activity B from the Gizmo	Complete questions 1 - 2 on the “Conclusion” part of the task
<b>Assessment/Summary</b>	TOTD: Textbook Resource: Lesson Check: Mixed Groups	Finish Textbook Resources: SmartBook: Types of Bonds for homework	Have students complete the 5 question Gizmo assessment	Independently, students should complete the 5 question Gizmo assessment	Think-Pair-Share: Conclusion question number 3, then each group share out their findings
<b>Small Group Tasks (TBA)</b>					
<b>Teacher Notes</b>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	Polarity is not mentioned in the language of the standard.  <a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>

### Week 3

**GSE: c.** Use the International Union of Pure and Applied Chemistry (IUPAC) nomenclature for translating between chemical names and

**Focused Concept:**  
Naming Ionic and Covalent Compounds  
Writing Formulas for Ionic and Covalent Compounds



chemical formulas.  
 (Clarification statement: Limited to binary covalent and binary ionic, containing main group elements, compounds but excludes polyatomic ions.)

**Phenomenon:** Making salt (sodium chloride):  
<https://goo.gl/LODHSo>

**DQ: How do I translate between chemical names and chemical formulas?**

- SEP:**
- Ask Questions.
  - Obtain, Evaluate, and Communicate Information.

- CCC:**
- Patterns

	Day 11	Day 12	Day 13		
<b>Learning Target</b>	SWBAT write and name covalent compounds.	SWBAT write and name ionic compounds.	SWBAT score a 75% or higher on the unit assessment.		
<b>Opening</b>	<p><b>Inspire Physical Science Module 18: Lesson 3: Writing Formulas &amp; Naming Compounds</b></p> <p>Go through the Teacher PowerPoint: Writing Formulas &amp; Naming Compounds for this lesson in your textbook resources. Students should take notes throughout the PowerPoint.</p>	<p><b>Inspire Physical Science Module 18: Lesson 3: Writing Formulas &amp; Naming Compounds</b></p> <p>Play this <a href="#">video</a> to review naming binary ionic and covalent compounds</p> <p>Play this <a href="#">video</a> for Covalent Compounds</p> <p>Teacher Actions:            Teacher pauses and discusses key points from the video.            Teacher ask probing questions such as, “What will you learn in this lesson? What are some key points from the video?”</p> <p>Student Actions:            Students will complete a KWL chart in their notebooks for these videos.</p>	<p>Review unit 2 standards and elements by annotating them whole class and have a discussion the meaning of each standard/element.</p> <p><a href="#">SPS1 Annotation Guide</a>  <a href="#">SPS2 Annotation Guide</a></p>		

<p><b>Guided Practice/Transition</b></p>	<p>Review the <a href="#">prefixes</a> for naming covalent compounds (mono, di, tri, etc.) Practice naming the following covalent compounds: ClF<sub>3</sub>, N<sub>2</sub>O<sub>5</sub> Practice writing the formulas for: Sulfur Trioxide, Dinitrogen tetroxide</p> <p>Textbook Enrichment: The Crisscross Method</p> <p>Practice naming the following ionic compounds: NaCl, NaF Practice writing the formulas for: Potassium Bromide, Copper (1) Chloride</p>	<p>In pairs, students should complete the following task</p> <p>Textbook Online Resource: Explore and Explain: Naming Binary Covalent Compounds</p>	<p>Play a review game using the questions from</p> <p><a href="#">Unit 2 Assessment Presentation</a></p>		
<p><b>Independent Practice</b></p>	<p>Textbook Online Resource Directed Reading for Content Mastery: Writing Formulas and Naming Compounds (Skip 1 and 6)</p>	<p>Textbook Online Resource SmartBook: Writing Formulas and Naming Compounds</p>	<p>Unit 2 Assessment</p>		
<p><b>Assessment/Summary</b></p>	<p>Go over independent practice whole class to address misconceptions</p>	<p>Ticket Out the Door: Write the formula for Dinitrogen trioxide and the name for H<sub>2</sub>S</p>	<p>Go over assessment data and address misconceptions</p>		
<p><b>Small Group Tasks (TBA)</b></p>					
<p><b>Teacher Notes</b></p>	<p>Polyatomics and hydrates are not part of the standard and are beyond the scope of this course. Skip these portions when delivering this lesson.</p> <p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>		

### Assessment Prep

Prepare students for assessment by reviewing the following Assessment Prep Presentation.

#### [Unit 2 Assessment Presentation](#)

Provide the following guidance:

Ask the students to use what they know about the tasks completed to answer the provided assessment prep question.

- What is the question asking you?
- What do you know about the vocabulary or concept in the question?
- Is this question similar to any investigations or tasks we've completed?
- How can what you've done help you answer this question?
- Just view the assessment question: What is the question asking you?

Guide students to think about how their experience connects to the question.

Using the answer choices provided, ask the students the following:

- Identify a wrong answer: How do I know this answer is incorrect?
- Identify the right answer: How do we know this answer is correct?

Allow the students time to discuss in collaborative groups.

**TEACHER NOTE:** If students struggle with the question, review it the next day. Do not rush to the next question; instructional time is the only time they have to prepare for the end-of-year assessment.

### Labs / Investigations

ADI Labs	Explore Learning Gizmo	Pivot Interactives/Phet
ADI: <b>Chemistry</b> Lab 7. Periodic Trends: Which Properties of the Elements Follow Periodic Trends?  *Virtual resource: Gizmo: Periodic Trends	<b>Ionic Bonding</b> <b>Covalent Bonding</b> <b>Element Builder</b> <b>Electron Configuration</b> <b>Chemical Equations</b>	Build an Atom: <a href="https://phet.colorado.edu/en/simulation/build-an-atom">https://phet.colorado.edu/en/simulation/build-an-atom</a> Build a Molecule: <a href="https://phet.colorado.edu/en/simulation/legacy/build-a-molecule">https://phet.colorado.edu/en/simulation/legacy/build-a-molecule</a> Atomic Interaction: <a href="https://phet.colorado.edu/en/simulation/atomic-interactions">https://phet.colorado.edu/en/simulation/atomic-interactions</a>

Isotopes and Atomic Mass:  
<https://phet.colorado.edu/en/simulation/isotopes-and-atomic-mass>

### Additional Resources/Tasks

#### Supplemental Resources

Atom and Ion Builder: <https://lab.concord.org/embeddable.html#interactives/interactions/atom-builder-with-table.json>

Structure of an Atom: <https://learn.concord.org/resources/846/structure-of-an-atom>

Mystery Isotope: <http://www.cpalms.org/Public/PreviewResourceLesson/Preview/51015>

Engineering and the Periodic Table: [https://www.teachengineering.org/activities/view/cub\\_mix\\_lesson2\\_activity1](https://www.teachengineering.org/activities/view/cub_mix_lesson2_activity1)

<https://inspire.gadoe.org/course/40.0110/0>

[Lewis Dot for Covalent Bonding](#)

[Naming Covalent Compounds Worksheet](#)

[Naming Binary Ionic Compounds Worksheet](#)

[Ionic Bonds Worksheet](#)