

Unit Overview	
Unit Title:	Why do chemical reactions occur?
Teacher:	Ms. Katie Fisher
Grade Level/Course:	10 th grade chemistry
Length/Dates:	2 weeks
Unit Summary:	We will use the periodic table to determine the properties of elements and use that knowledge to predict the outcome of simple chemical reactions and explain why they occur.

Stage 1: Desired Results

Graduation Standards	
<p>Guiding Principle: Creative + Practice Problem Solver (C.3)</p> <p>Physical Sciences: Structure/Properties of Matter, Forces, and Interactions (PS 1 + PS 2)</p>	
Primary Indicators	Supporting Indicator(s)
<p>A. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS-PS1-1)</p> <p>B. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (HS-PS1-2)</p>	<p>F. Use mathematical representations to support the claim that atoms, and therefore, mass, are conserved during a chemical reaction. (HS-PS1-7)</p>

Essential Question(s)	<ul style="list-style-type: none"> ▪ How do models help scientists predict phenomena? ▪ Why do chemical reactions occur?
Enduring Understandings	<ol style="list-style-type: none"> 1. The periodic table is a powerful model that describes and predicts properties and trends of elements. 2. All matter is made up of elements that react and combine in ways that can be explained and predicted. 3. The periodic table can be used to predict trends in the chemical and physical properties of compounds made from simple chemical reactions between elements or an element and a compound.

What will students know	What will students be able to do
<ul style="list-style-type: none"> ▪ How to use the periodic table to make predictions about an element's physical properties and chemical behavior. ▪ That the arrangement of electrons in an atom is a predictor of chemical behavior. ▪ How energy levels of electrons are related to the chemical properties of atoms. 	<ul style="list-style-type: none"> ▪ Describe basic atom structure of elements ▪ Describe important physical and chemical properties of elements ▪ Use the periodic table to explain patterns across a row and in a column ▪ Use the periodic table to determine the number of electrons in the outermost energy level ▪ Predict physical and chemical properties of an atom given its electronic structure ▪ Balance chemical equations ▪ Apply an understanding of physical and chemical properties of matter to practical situations ▪ Determine the product of a simple chemical reaction ▪ Identify patterns, trends, and relationships that apply to solutions (Guiding Principle C.3)

Stage 2: Evidence of Student Learning

Task Neutral Scoring Criteria				
Indicator	1	2	3	4
<p>Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS-PSI-1-1)</p>	<p>Student is able to locate an element on the periodic table.</p>	<p>Student is able to locate an element on the periodic table, identify its basic properties, and determine the number of electrons in the outermost energy level.</p>	<p>Student is able to use the periodic table to accurately predict relative physical and chemical properties of elements.</p> <p>Student is able to describe the relationship between the pattern of electrons and other characteristics of that element.</p>	<p>Student is able to analyze observed relative physical and chemical properties of elements and classify them appropriately in the periodic table.</p>
<p>Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (HS-PS1-2)</p>	<p>Student is able to determine the outcome of a simple chemical reaction.</p>	<p>Student is able to determine the outcome of a simple chemical reaction and explain it in relation to the elements' location on the periodic table.</p>	<p>Student is able to use their knowledge of the periodic table to predict the outcome of simple chemical reactions.</p> <p>Student is able to explain the outcomes by explicitly referencing the periodic table and its inherent patterns such as outermost electrons, trends, and properties.</p>	<p>Student is able to compare the results of different chemical reactions and explain the differences in outcomes by explicitly referencing the periodic table and its inherent patterns such as outermost electrons, trends, and properties of the reactants.</p>

Task Neutral Scoring Criteria				
Indicator	1	2	3	4
<p><i>Creative and Practical Problem Solver: Identifies patterns, trends, and relationships that apply to solutions.</i> (C.3)</p>				

Summative Assessment Task

Part 1

HS-PS1-1: Demonstration of each student's ability to analyze observed relative and physical and chemical properties of elements and classify them appropriately in the periodic table.

Given a location of an element on the periodic table:

- Predict physical and chemical properties of the element, including reference to
 - the electron configuration of the element and how this configuration explains its properties
 - the relationship between the number of valence electrons and the reactivity of the element
- Based on the location of this element on the periodic table, name elements that are more or less reactive than the element described, and support your rationale with relevant evidence.

Part 2

HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

GP-C.3 Creative and Practical Problem Solver: Identify patterns, trends, and relationships that apply to solutions.

Given two elements, use the periodic table to:

- Describe and illustrate (using a Lewis Dot structure) the electron configuration of each element and use the configuration as a

rationale to explain its properties

- Predict the outcome of the chemical combination of these two elements by writing and balancing a chemical equation

After watching a series of videos of the two elements reacting, (with no verbal explanation) use your knowledge of the periodic table to:

- Explain the outcome of the reaction
 - What conditions were essential for the reaction to occur?
 - Support observations from the reaction using periodic trends, patterns, and relationships of elements
- Identify the product formed as a result of the chemical reaction
- Write and balance a chemical reaction for what occurred in the video

Reflection:

- Was your initial prediction supported by the evidence in the video?
- How did your explanation of the reaction change as a result of watching the video of the reaction?

Extension/Challenge:

Given information from an analysis (atomic weights, electron structure, etc.) of new elements from a newly discovered solar system, use the properties from the analysis to propose a new periodic table that shows the trends and properties of these new elements.

(HS-PS1-1, HS-PS1-2, C.3)

Stage 3: Instructional Design

Hook

1. Ask students to observe a burning candle and list their observations. Then ask students to identify chemical and physical changes occurring as the candle burns.
2. Illustrate the range of chemical reactions that impact our daily lives via a series of short demonstrations of simple, spontaneous chemical reactions and reactions that occur more slowly, over time. With each reaction, point to where the elements are in the periodic table. Display the various ways elements are found in nature, how they naturally occur: for example: iron ore, carbon as coal, oxygen, nitrogen, silicon (as sand , other) magnesium, lead, aluminum, etc.

Pre-assessment

HS-PS1-1, 1-2 and 1-7

1. In small groups, ask students to list what they know about the periodic table and why they think it is organized in a particular way rather than just a list of the elements.
2. Give students a written pre-assessment on the structure of matter, chemical and physical change, chemical and physical properties to assess what they know prior to the unit.

Learning Targets	Formative Assessment(s)	Learning Experiences
I can draw on prior knowledge to illustrate the basic structure of an atom. (HS-PS1-1, HS-PS1-2, C.3)	Pre-assessment: written + small group periodic table discussion Pre-assessment: students draw an atom of an element	Unpack the performance indicators with students. Review the rubric that will be used to assess their work in this unit.
I can describe the properties of an element based on its placement in the periodic table. (HS-PS1-1)	Distribute index cards at random with one element per card. Students describe the properties of that element based on its position on the periodic table. (use as small group discussion starter or exit ticket)	Classification of the elements in the periodic table. Students will color code and label the periodic table.
I can describe the variety of chemical and physical properties of elements. (HS-PS1-1)	Whole group questioning: Teacher asks questions to check for recognition that some elements are more reactive than others, some occur as elements in nature. What patterns are emerging?	Students will observe a variety of reactions between elements and compounds and between compounds. Sample reactions: <ul style="list-style-type: none">- Metals reacting in water (potassium, sodium, iron, aluminum)- Metals reacting to flame (magnesium, iron, aluminum), heat.

	<p>Where are the most reactive elements?</p> <p>Student notes: observations, how they know a reaction has occurred, and location on periodic table</p>	<p>- Elements reacting with familiar compounds such as acetic acid.</p> <p>Students will record observations and explain how they know when a reaction has occurred. They will note where the element or compound containing a specified element is located in the periodic table.</p>
<p>I can explain the patterns of chemical and physical properties of elements across a row and down a column in the periodic table. (HS-PS1-1; GP C.3)</p> <p>I can predict how elements are going to react with one another based on their placement in the periodic table. (HS PS1-1; GP C.3)</p>	<p>Based on their knowledge of properties from last class, students will predict what will happen for each reaction.</p> <p>Think-pair-share: After each demonstration, students record their observations and discuss with their lab partner why these reactions may have occurred. Each pair shares an observation or insight with the class.</p>	<p>Students will create a variety of reactions between elements and compounds given a set of materials and basic safety guidelines.</p> <p>Students will continue to record their observations, noting where an element is located on the periodic table and what properties it displays.</p>
<p>I can describe how elements react with one another based on the arrangement of electrons in their outermost shell. (HS-PS1-2)</p>	<p>Quick Write Question: Compare the reactivity of elements based upon available electrons.</p> <p>How does the electron configuration change across a row and within a column in the periodic table?</p>	<p>Working in groups and using the observation data and elements from the first two lessons, students will compare the number of electrons in the outermost energy level to each element presented.</p> <p>Students will group the elements by the number of electrons in the outermost energy level.</p> <p>Students will then place these elements in their proper position on a blank periodic table (given a complete table to use for comparison) and label each column with the number of electrons in the outermost energy level. They will identify metals, non-metals and gases and note location on the table and observed properties of each.</p>

<p>I can use the periodic table to determine the number of electrons in the outermost energy level of an element. (HS-PS1-1)</p> <p>I can explain the arrangement of electrons of an element based on its placement in the periodic table. (HS-PS1-1)</p>	<p>Given different elements and a periodic table as a reference, students will illustrate the number of electrons in the outermost energy level of an element using a Lewis Dot Diagram.</p> <p>Review and select diagrams for use in next class. Identify misconceptions to address at the beginning of class.</p>	<p>Stations:</p> <ul style="list-style-type: none"> ▪ Lewis dot structures ▪ Lab station- reactions of a variety of elements ▪ Videos of reactions ▪ Manipulative- create a model of an element
<p>I can explain the relationship between the energy levels of electrons and an element's chemical properties. (HS-PS1-2)</p>	<p>Quiz: Atomic structure and element properties</p>	<p>Each working group will have a different set of configurations to identify and place on the periodic table (using their "blank" from the previous day).</p> <p>Students will present their results to other groups for peer critique. Groups will report out to the class and the class will come to agreement of accuracy.</p>
<p>I can balance a simple chemical reaction. (HS-PS1-2)</p> <p>I can determine the product of a simple chemical reaction. (HS-PS1-2)</p>	<p>White board responses: The last 15 minutes of class, each student receives their own whiteboard. Teacher writes elements on the board, students write a balanced chemical equation and hold up their board. Teacher provides immediate feedback and support to students who need it.</p>	<p>Students will use diagrams constructed last class to diagram the chemical bonding between specific families of elements and note the patterns and trends between and among chemical families and rows of elements.</p> <p>Students will construct simple chemical equations based on their diagrams.</p>
<p>Putting it all together: I can describe properties of elements based upon</p>	<p>Students first work individually, then in groups to check results. Teacher conferences with each</p>	<p>Given an element, describe its properties, including the electrons in the outermost energy level, and where it fits in relation to other elements in that row and group of the periodic</p>

<p>location in the periodic table. (HS-PS1-1)</p> <p>I can predict the type of reaction and chemical compound elements will form and construct an explanation of the chemical reaction. (HS PS1-1; GP C.3)</p>	<p>student individually to check for understanding.</p>	<p>table.</p> <p>Find an example of the element in a chemical compound and explain how the chemical compound comes about. Compare the element to something that is more reactive and less reactive.</p> <p>Properties- chemical and physical, describe in relation to the periodic table where that element fits in terms of its trends (row and group), and provide two examples of simple chemical reactions that that element is a part of- write the equation, balance it, and explain why it occurs.</p>
<p>Performance Indicators:</p> <p>I can use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS-PS1-1)</p> <p>I can construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (HS-PS1-2)</p>	<p>Summative Assessment Task Practice</p>	<p>Students will individually select pairs of elements for this.</p> <p>Given two elements use the periodic table to:</p> <ul style="list-style-type: none"> ▪ Describe its properties. ▪ Explain its properties in relation to other elements in the same row and group. ▪ Predict the outcome of the chemical combination of these two elements. ▪ Predicts the conditions under which the two elements would be able to combine to create a chemical compound. ▪ Explain your solution based on your knowledge of the number of electrons in each element's outermost energy level and the elements' positions in the periodic table.

Resources

Aligned to Performance Indicators

HS-PS1-1

[Chemical and physical properties of elements](#)

[Historical perspective of periodic law](#)

[DOC][Unit Plan for The Periodic Table](#)

[Interactive periodic table of the elements](#)

[Periodic table position and electron configuration](#)

[Videos illustrating reactivity of elements in the periodic table](#)

HS-PS1-2

[Valence electrons and energy levels of atoms and elements](#)

[Wikibooks- High School Chemistry- The Periodic Table and Electron Configuration](#)

[Video: Electron configurations and energy levels](#)

[Quantum mechanical viewpoint](#)

[Phet: Balancing Chemical Equations Simulation](#)

Stage 4: Reflection

Student Reflection

Journal entry:
Write a reflection.

1. If one of your family members asked what you learned today in school, what would you say you learned during this particular unit.
2. Select one of the performance indicators we assessed during this unit and describe one struggle you had with it. What helped you become successful with it?

Teacher Reflection

1. We had to spend more time at the beginning of the unit reviewing atomic structure than I had originally planned for, causing the unit to last about 3 weeks.
2. After the pre-assessment, I regrouped students to be sure I had mixed-ability groups for the subsequent activities. This seemed to help the students that were still struggling with basic atomic structure concepts.
3. It is important to have basic print-outs of the periodic table to hand-out each day- some students lose theirs or write on them. I found with quizzes and the summative assessment it was just easier to give everyone a new one.