



Science Grade 08 Unit 03 Exemplar Lesson 01: Arrangement of the Periodic Table

This lesson is one approach to teaching the State Standards associated with this unit. Districts are encouraged to customize this lesson by supplementing with district-approved resources, materials, and activities to best meet the needs of learners. The duration for this lesson is only a recommendation, and districts may modify the time frame to meet students' needs. To better understand how your district may be implementing CSCOPE lessons, please contact your child's teacher. (For your convenience, please find linked the TEA Commissioner's List of [State Board of Education Approved Instructional Resources](#) and [Midcycle State Adopted Instructional Materials](#).)

Lesson Synopsis

Based on the interpretation of patterns in groups/families and periods on the periodic table, students will explain how properties are used to classify elements.

TEKS

The Texas Essential Knowledge and Skills (TEKS) listed below are the standards adopted by the State Board of Education, which are required by Texas law. Any standard that has a strike-through (e.g. ~~sample phrase~~) indicates that portion of the standard is taught in a previous or subsequent unit. The TEKS are available on the Texas Education Agency website at <http://www.tea.state.tx.us/index2.aspx?id=6148>.

8.5 *Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:*

8.5B Identify that ~~protons determine an element's identity and~~ valence electrons determine its chemical properties, including reactivity.

Readiness Standard

8.5C Interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements.

Readiness Standard

Scientific Process TEKS

8.2 *Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:*

8.2E Analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

8.4 *Scientific investigation and reasoning. The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to:*

8.4A Use appropriate tools to collect, record, and analyze information, including lab journals/notebooks, ~~beakers, meter sticks, graduated cylinders, anemometers, psychrometers, hot plates, test tubes, spring scales, balances, microscopes, thermometers, calculators, computers, spectrometers, timing devices, and other equipment as needed to teach the curriculum.~~

GETTING READY FOR INSTRUCTION

Performance Indicators

Grade 08 Science Unit 03 PI 01

Create an advertisement, written from the perspective of a period or group, for a new element to add to the periodic table. Include a response from an element indicating what properties it possesses that allows it to fit within the trends of the period or group.

Standard(s): 8.2E , 8.5B , 8.5C

ELPS ELPS.c.1E , ELPS.c.5D , ELPS.c.5G

Key Understandings

- The periodic table, arranged by atomic number, shows a tendency for properties to repeat in a periodic pattern and can be used to predict the properties of an element.
 - What are some patterns (trends) found in the periodic table of elements?
 - How are elements on the periodic table organized?
 - How is the chemical reactivity of an element determined?
 - How does the arrangement of elements on the periodic table allow for the prediction of undiscovered elements and their properties?
- Elements are grouped into families on the periodic table.
 - How are groups of elements similar/different?
 - How are periods of elements similar/different?

— How do groups and periods of elements compare?

Vocabulary of Instruction

- periodic trend
- atomic number
- reactivity
- metals
- valence electrons
- groups/families
- periods
- alkali metals
- nonmetals
- metalloids
- noble gases
- transition metals

Materials

- chart paper (1 per group)
- colored pencils (5 per pair or group)
- glue or tape (1 per group)
- index cards (labeled with questions, see Advance Preparation, 1 per group)
- markers (1 per group)
- markers or colored pencils (1 set per table)
- paper (construction, chart, or other variety, for written advertisements, 1 per student)
- periodic table (black and white, see Advance Preparation, 1 per student)
- periodic table (posted or displayed, see Advance Preparation, 1 per classroom)
- tape (masking, 1 loop of tape per student)

Attachments

All attachments associated with this lesson are referenced in the body of the lesson. Due to considerations for grading or student assessment, attachments that are connected with Performance Indicators or serve as answer keys are available in the district site and are not accessible on the public website.

 [Teacher Resource: Where Do I Belong \(see Advance Preparation, 1 set per class\)](#)

 [Handout: Two Column Notes \(1 per student\)](#)

 [Teacher Resource: PowerPoint: The Periodic Table](#)

 [Handout: Match the Elements \(1 per student\)](#)

 [Handout: Match the Elements KEY](#)

 [Teacher Resource: Brief History of the Periodic Table \(see Advanced Preparation\)](#)

 [Teacher Resource: Periodic Trends \(for projection\)](#)

 [Optional Handout: Valence Electrons and Energy Levels \(1 per student\)](#)

 [Teacher Resource: Valence Electrons and Energy Levels KEY](#)

 [Optional Handout: Riddle Me This \(1 per student\)](#)

 [Teacher Resource: Riddle Me This KEY](#)

 [Teacher Resource: Evaluate Instructions PI \(1 for projection\)](#)

Resources

None Identified

Advance Preparation

1. Prepare a class set of index cards, one per group, with labels of places where items are organized by categories. For example: grocery store, library, etc.
2. Prepare one set of cards per class from the Teacher Resource: **Where Do I Belong**. Cut cards apart. There are 20 items in the set, so you will have one card per student up to 20; consider pairing students if more than 20 students are in the class. However, every student will need their own card to affix to their notebooks.
3. Project or post a periodic table in the classroom. It is recommended that the periodic table from the STAAR Grade 8 Science Reference Materials be used to create the poster, if possible.
4. Find a black and white periodic table for students to color code (see Resources above). The table should show the element symbol, name, mass, atomic number, group numbers, and periods. You will need one per student.
5. Conduct an internet search for images of various versions of the periodic table to project. There are images of cylindrical, circular, 3-dimensional, and various linear charts at the following URL: <http://www.meta-synthesis.com/>
6. Make one copy of Teacher Resource: **Brief History of the Periodic Table**. Cut the resource into 10 strips to be used for student readers.
7. Prepare five index cards with one of the following questions written on each.

- What does periodic mean?
- What does trend mean?
- What might be a good definition for periodic trends?
- What are some of the patterns found in the periodic table?
- How does the arrangement of the periodic table allow for the prediction of undiscovered elements and their properties?

8. Prepare attachment(s) as necessary.

Background Information

In Unit 02, students learned about the relationship between atomic structure and the periodic table. During this lesson, students use patterns in physical and chemical properties to organize information to help them understand placement of elements on the periodic table. Students examine information on the periodic table to recognize that elements are grouped into families.

STAAR Note:

Arrangement of the Periodic Table of the Elements to explain classification of elements will be assessed as a Readiness Standard under Reporting Category 1: Matter and Energy on the STAAR Grade 8 Science Assessment.

INSTRUCTIONAL PROCEDURES

Instructional Procedures ENGAGE /EXPLORE – Store Organization	Notes for Teacher NOTE: 1 Day = 50 minutes Suggested Day 1
<p>1. Post the following question on the board:</p> <ul style="list-style-type: none"> • Where are some places you have visited that have areas or items organized into categories? <p>2. Instruct students to answer the question in their science notebooks.</p> <p>3. Ask for a few volunteers to share their answers and some examples. Answers will vary, but <i>grocery stores and the library are most common.</i></p> <p>4. Divide students into groups. Each group should receive one card depicting a place where items are organized into categories. (For example: library, grocery store, discount store, clothing store, etc.)</p> <p>5. Instruct students to work collaboratively with group member(s) to brainstorm a list of at least 10 items found in the place listed on their card. They should create their own system to organize these items in a table on chart paper. Properties of the items and the name of the aisle/category/location should be included, for example: <i>vegetables should be stored in cool places in the produce section; dairy products need refrigeration; detergent smells strongly and should not be near fresh food; and ice cream needs to be frozen. Other examples could include: electronics, shoes, gender/age clothing, school supplies, etc.</i></p> <p>6. Each group should share their poster and explain their process of organization.</p> <p>7. Ask:</p> <ul style="list-style-type: none"> • Why is a system of organization important? <i>Organization makes it easier to find objects, provides proper storage, etc.</i> • What do a store or library and the periodic table of the elements have in common? <i>The structure and properties of atoms/elements are used to organize the periodic table just as a grocery store organizes food by its properties. (Remind students to think about the last unit and how it connected atomic structure to the periodic table.)</i> 	<p> Materials:</p> <ul style="list-style-type: none"> • index cards (labeled with categories, see Advance Preparation, 1 per group) • chart paper (1 per group) • markers (1 per group) <p>Instructional Notes: Post charts around the room.</p> <p>Groups should stand next to their chart to explain their system of organization.</p> <p> Science Notebooks: Record the answers to the questions within the engagement activity.</p>
EXPLORE – Grouping Atoms by Structure	Suggested Days 1 (continued) and 2
<p>1. As a review of the previous lesson, Ask:</p> <ul style="list-style-type: none"> • What does the atomic number tell us about atoms? <i>The atomic number is the number of protons in an atom.</i> • How do we know the number of electrons in a neutral atom? <i>The number</i> 	<p> Materials:</p> <ul style="list-style-type: none"> • tape (masking, 1 loop of tape per student)

of electrons is equal to the number of protons in a neutral atom.

- **Where are electrons located in an atom?** *Electrons are found in energy levels outside the nucleus.*
- **What name do we give the electrons in the outermost energy level of an atom?** *The electrons in the outermost level are called valence electrons.*

2. After recording the answers in their science notebooks, students should explain their answers to another student. (see Instructional Note)
3. Allow a few volunteers to answer in the large group setting.
4. Distribute one element card from Teacher Resource: **Grouping Atoms by Structure** to each student. If you have more than 20 students, pair the students until you have 20 total.
5. Students will identify which neutral element he or she has by counting electrons to determine the number of protons (atomic number). They are to record the element name and atomic number on the back of the card.
6. After they have this information, instruct students to organize themselves into groups/columns based on the information on each card. Remind students to look for patterns. (Model what this looks like using birth months.)
7. Once they have organized themselves, students should place a looped piece of tape to the back of their card and arrange their groups/columns vertically on the board or wall.
8. Allow each group/column to share the patterns they used to organize themselves. Students should record in their science notebooks what pattern(s) they used to group their elements. Answers may vary, *but they should recognize the increasing number of electrons/protons, increasing number of energy levels, number of valence electrons, etc.*
9. Allow students to reorganize their group or move cards to another group if necessary.
10. While the cards are taped on the board or wall, ask students to step back and look for patterns.
11. Ask:
 - **What patterns do you see?** *Answers may vary, but they should recognize the increasing number of electrons/protons, increasing number of energy levels, number of valence electrons, etc.*
 - **What do the vertical columns have in common?** *Same number of valence electrons*
 - **What do the horizontal rows have in common?** *Same number of energy levels*
 - **What changes as you move across the table from left to right?** *Increasing atomic number (protons, electrons), increasing valence electrons*
12. Students should tape their element card into their science notebooks and record the following:
 - element name
 - atomic number
 - number of protons
 - number of electrons
 - number of valence electrons
 - number of energy levels

Attachments:

- Teacher Resource: **Grouping Atoms by Structure** (see Advance Preparation, 1 set per class)

Instructional Notes:

Allowing students to talk with other students about the concept helps with auditory and verbal processing through speaking and listening. After talking through the answers with others, reluctant students will be more confident to answer orally.

Students will have limited knowledge of the periodic table at this point. If a student is in a "wrong" position, ask clarifying questions to guide them to the correct location.

Example: What does your element have in common with the others in your group?

Facilitate by helping students see patterns.



Science Notebooks:

Students respond to questions and record patterns used to group elements. Additionally, students affix their element card in the notebooks and record information about the element.

EXPLAIN – Organization of the Periodic Table

1. Distribute a copy of Handout: **Two Column Notes** to each student. Explain the format. Instruct students to look for answers to the questions on the handout as we view the PowerPoint presentation.
2. Show Teacher Resource: PowerPoint: **The Periodic Table**. Emphasize the slides where answers are found. Allow time for students to complete the handout.
3. Instruct students to affix the Handout: **Two Column Notes** to their science

Suggested Days 3 and 4



Materials:

- periodic table (posted or displayed, see Advance Preparation, 1 per classroom)
- glue or tape (1 per group)

notebook.

4. Stop after each section to clarify and check for understanding.
5. Use a wall periodic table or project a periodic table, and have volunteers point out the answers to the following questions:
Ask:
 - **Which elements have one valence electron?** (*Alkali metals or Group 1*)
 - **What elements would have properties similar to astatine?** (*Cl, F, Br, I, or Group 17*)
 - **How many valence electrons do the elements in Group 18 have?** (*8 except Helium, which has only 2 valence electrons*)
 - **What is common in each group of elements?** (*Number of valence electrons*)
 - **What is the relationship between the group and the number of valence electrons?** (*They are the same.*)
 - **What do elements in each period have in common?** (*The number of energy levels*)
 - **Where do you find metalloids?** (*Either side of the zigzag line on the periodic table*)
 - **What is the purpose of the zigzag line in the periodic table?** (*To separate the metals from the nonmetals*)
6. Use the “I do, We do, You do” strategy by modeling and practicing with a similar example prior to passing out the Handout: **Interpreting the Periodic Table**.
7. Distribute a copy of the Handout: **Interpreting the Periodic Table** to each student.
8. Monitor and assist students as they complete the handout.
9. Use an exit ticket strategy to wrap up the lesson. Instruct students to copy down and answer the following:
 - **Where are the periods located on the periodic table?**
 - **What do all of the elements in the same period have in common?**
 - **Where are the groups/families located on the periodic table?**
 - **What do all of the elements in the same group have in common?**
 - **What is the significance of valence electrons in an element?**

Attachments:

- Handout: **Two Column Notes** (1 per student)
- Teacher Resource: PowerPoint: **The Periodic Table**
- Handout: **Interpreting the Periodic Table** (1 per student)
- Handout: **Interpreting the Periodic Table KEY**



Check For Understanding:

Using an exit ticket strategy allows for immediate feedback.



Science Notebooks:

Students affix the Handout: **Two Column Notes** to the notebook.

EXPLORE – Labeling the Periodic Table

1. Distribute a copy of a black and white periodic table to each student. The table should not be shaded but should have the atomic number, mass, symbol, name of each element, group numbers, and periods included on it. Consider using the table from the STAAR Grade 8 Science Reference Materials.
2. Instruct students to use a textbook, Internet, or notes and color in the divisions of the table listed below. They are to make a key for their table:
 - metals
 - nonmetals
 - metalloids
 - noble gases
 - Hydrogen
3. Direct students to make three columns titled: Metals, Metalloids, and Nonmetals in their science notebooks.
4. Instruct students to list the physical properties of each category listed.
Answers:
 - *Metals: malleable, shiny, good conductors of electricity and heat. Some are magnetic.*
 - *Metalloids: have properties of both metals and nonmetals*
 - *Nonmetals: brittle, dull, poor conductors of electricity and heat. Some are insulators.*

Suggested Day 5



Materials:

- periodic table (black and white, see Advance Preparation, 1 per student)
- colored pencils (5 per pair or group)

Instructional Notes:

This optional site has basic information about the periodic table for the students to read. There is also a quiz for formative assessment.

http://www.chem4kids.com/files/elem_ptable.html.

Note: Resources are rarely completely aligned to the state standards. Please preview the source and check which portions are correctly aligned to your instruction.

Students studied properties of metals, nonmetals, and metalloids in Grade 6.



Check For Understanding:

5. Use an exit ticket strategy to wrap up the lesson. Instruct students to copy the following questions down and answer them as their exit ticket “out the door”. Students will use their periodic table to decide which element is a misfit. **Circle the misfit and explain why the element does not fit.**

- **Lithium, Magnesium, Sulfur** Answer: *Sulfur is a nonmetal.*
- **Oxygen, Carbon, Sodium** Answer: *Sodium is a metal.*
- **Calcium, Aluminum, Silicon** Answer: *Silicon is a metalloid.*

The exit ticket strategy may be done orally, on loose paper as students leave the classroom, or in their science notebook.



Science Notebooks:

Use the Periodic Table of the Elements from the STAAR Grade 8 Science Reference Materials to affix to notebooks. Consider the inside of the back cover for easy pull out reference.

EXPLAIN – Brief History of the Periodic Table

1. By this point, students should be familiar with the current version of the periodic table of the elements.
Ask:
 - **Who developed the periodic table as we know it today?** *Most students will probably say Mendeleev.*
 - **Has the periodic table always looked the way it does now?** Answers may vary as students probably have never thought about it.
2. Project a copy of the Teacher Resource: **Brief History of the Periodic Table**. Allow students time to read through it.
3. Ask for volunteers to read each section of the timeline. Consider cutting a copy of Teacher Resource: **Brief History of the Periodic Table** into ten strips. Distribute one strip to ten different students who are comfortable reading in front of others.
4. Show the images of various versions of the periodic table. There are images of cylindrical, circular, 3-dimensional, and various linear charts on-line. (see Instructional Note)
5. Refer back to the first Explore activity: **Grouping Atoms by Structure**.
Ask:
 - **Did the grouping change once you started posting them on the board?** Answers may vary, *but there may have been some rearrangement of the cards.*
 - **Was it easier to group the atoms once you understood the property needed to group them?** *Answers should be positive.*
 - **Do you think that the periodic table will remain in the same form as it is now?** Answers will vary. *Lead students to the possibility that there may be other elements to discover.*

Suggested Day 6

Attachments:

- Teacher Resource: **Brief History of the Periodic Table** (1 for projection, 1 copy, see Advance Preparation)

Instructional Notes:

One possible source for different representations of the periodic table is on The Chemogenesis Web Book site. Once in the site (see URL below), click on the Internet Database of Periodic Tables. From there click on table(s) you wish to view. URL: <http://www.meta-synthesis.com/>



Misconception:

- Students may think that there is only one version of the periodic table, and it has not changed.

EXPLORE/EXPLAIN – Patterns

1. Instruct students to have the periodic table they labeled in the Explore activity: **Labeling the Periodic Table** ready to use for this activity.
2. Divide students into groups to answer the following questions together and then to share out loud with the class.
3. For example: Organize students into five groups. Place a different question at each table. Students answer the question at their table then rotate to the next table to answer the next question, and so forth and so on. Students will be discussing and recording their answers in their science notebooks.
 - **What does periodic mean?** (*Recurring at regular intervals*)
 - **What does trend mean?** (*A pattern of gradual change or movement*)
 - **What might be a good definition for periodic trends?** (*Periodic trends are the tendencies of certain characteristics of the atoms to increase or decrease along a row or column of the periodic table of elements.*)
 - **What are some of the patterns found in the periodic table?** *Average atomic mass increases from left to right and then top to bottom, etc.*
 - **How does the arrangement of the periodic table allow for the prediction of undiscovered elements and their properties?** Answers should include an explanation on patterns and periodicity.

Suggested Days 6 (continued) and 7



Materials:

- periodic table – from previous activity (labeled, 1 per student)
- index cards (labeled with questions, see Advance Preparation, 1 per group)

Attachments:

- Teacher Resource: **Periodic Trends** (1 for projection)



Check For Understanding:

The “agree or disagree” activity provides an opportunity for a formative assessment.

4. Monitor and assist for engagement and task completion.
5. Allow each group to share answers in the large group setting. Instruct students to add to or modify their answers in their science notebooks.
6. Project Teacher Resource: **Periodic Trends**, and instruct students to add the arrows and labels to their periodic tables.
7. Project the following statements. Instruct students to copy down the statements and label them agree or disagree. They should justify why they agree or disagree with the statement.
 - **The following elements all belong to the same period: Ne, Ar, Kr, and Xe.** Answer: *Disagree because they all have different numbers of energy levels.*
 - **The following elements all belong to the same group/family: H, Li, Na, and K.** Answer: *Agree because they all have the same number of valence electrons.*
 - **All elements in group 13 have 3 valence electrons.** Answer: *Agree because all elements in group 13 have ten less than stated, and all elements in a group have the same number of valence electrons.*
 - **The chemical reactivity of an element is determined by its protons.** Answer: *Disagree because the reactivity is determined by the number of valence electrons*



Science Notebooks:

Students should record answers to questions in notebooks.

Periodic Trends should be added to the period table in notebooks.

Check for understanding can be written in notebooks.

ELABORATE – Valence Clues or Identifying Unknown Elements

Suggested Day 7 (continued)

1. Allow students to choose from one of two options.
Option 1
 2. Group students or allow students to work individually, and distribute the Handout: **Valence Clues** to each student.
 3. Demonstrate the example on the board.
Ask:
 - **How many valence electrons does the element have?** (2)
 - **What group should it belong to?** (Group 2)
 - **Is this group a metal or nonmetal?** (Metal)
 - **How many energy levels does the element have?** (2)
 - **What period should it belong to?** (2)
 - **What element is it?** (Period 2, group 2 = beryllium)
 4. Instruct students to complete the missing information using the periodic table. Monitor each student for accuracy and provide feedback.
- Option 2**
 5. Group students or allow students to work individually, and distribute the Handout: **Identifying Unknown Elements** to each student.
 6. Allow students to use a periodic table for this activity.
Say:
 - **Use a periodic table to identify the elements described in each statement. Write both the element name and symbol on the line provided.**
 7. Demonstrate the process for interpreting the clues and using the periodic table to find the element described.
Ask:
 - **Which characteristics of the periodic table helped you to identify the elements?** *The arrangement of periods, groups, valence electrons, and atomic numbers and what they indicate.*
 - **How does the arrangement of elements on the periodic table allow the prediction of undiscovered elements and their properties?** *The periodic trends of the elements allows for predictions of undiscovered elements as well as their properties. Because of the trends of increasing atomic mass, valence electrons and energy levels, and reactivity, the pattern is easy to extend.*



Materials:

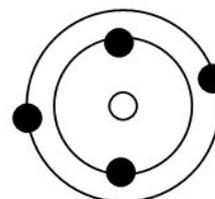
- periodic table – from previous activity (labeled, 1 per student)

Attachments:

- Optional Handout: **Valence Clues** (1 per student)
- Teacher Resource: **Valence Clues KEY**
- Optional Handout: **Identifying Unknown Elements** (1 per student)
- Teacher Resource: **Identifying Unknown Elements KEY**

Instructional Note:

Use this example for demonstration for Handout: **Valence Clues**.



EVALUATE – Want Ad and Reply

Suggested Days 8 and 9

Grade 08 Science Unit 03 PI 01

Create an advertisement, written from the perspective of a period or group, for a new element to add to the periodic table. Include a response from an element indicating what properties it possesses that allows it to fit within the trends of the period or group.

Standard(s): 8.2E , 8.5B , 8.5C

ELPS ELPS.c.1E , ELPS.c.5D , ELPS.c.5G

1. Refer to the Teacher Resource: **Evaluate Instructions PI** for information on administering the performance assessment.



Materials:

- periodic table – from previous activity (labeled, 1 per student)
- paper (construction, chart, or other variety, for written advertisements, 1 per student)
- markers or colored pencils (1 set per table)

Attachments:

- Teacher Resource: **Evaluate Instructions PI** (1 for projection)

Instructional Notes:

Give students ideas of what types of advertisement they can make including, written and/or illustrated, or consider allowing a video commercial type of advertisement. Provide examples of want ads from newspapers, Internet, etc.

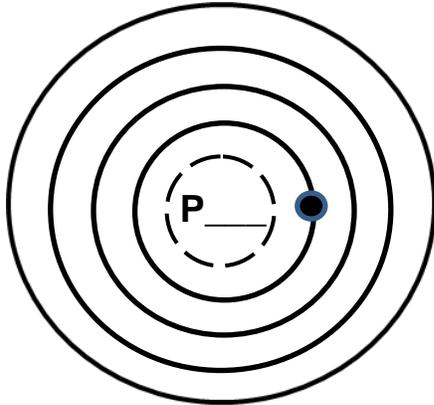


Science Notebooks:

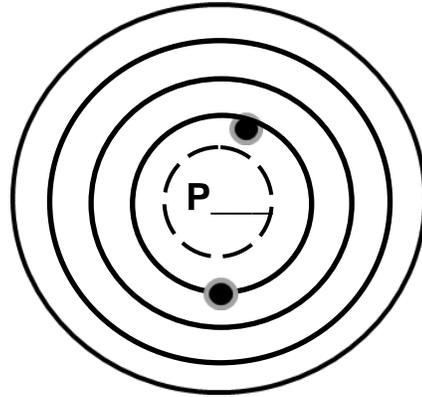
Students can use their notebooks, including their periodic table of the elements, to craft the drafts of their advertisements.

Where Do I Belong?

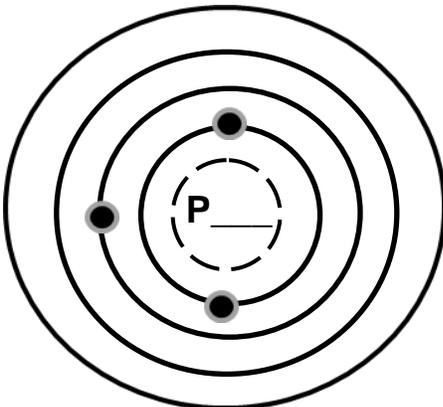
Who am I? _____



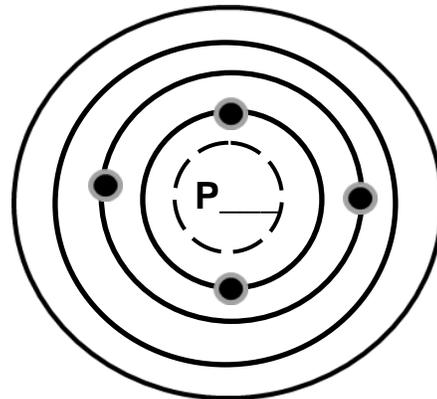
Who am I? _____



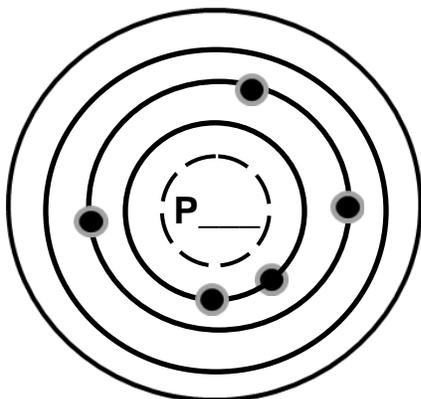
Who am I? _____



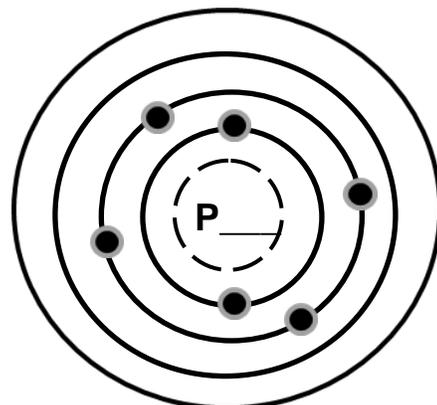
Who am I? _____



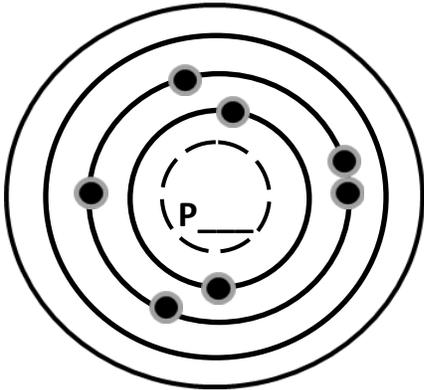
Who am I? _____



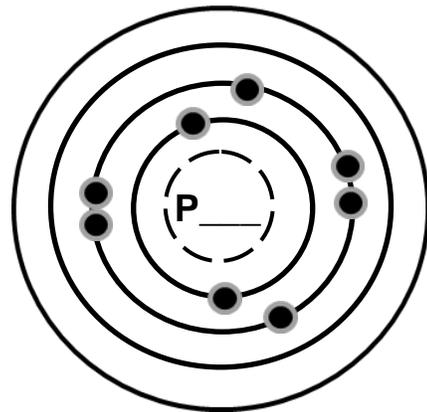
Who am I? _____



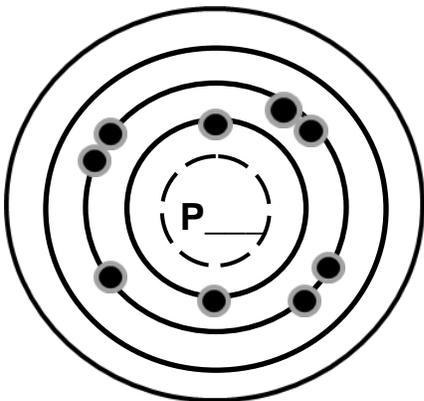
Who am I? _____



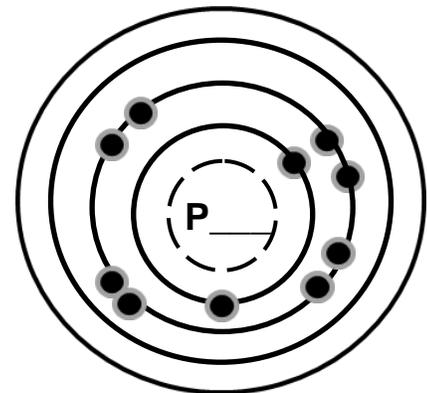
Who am I? _____



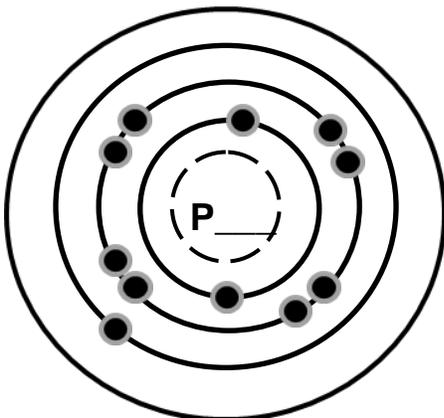
Who am I? _____



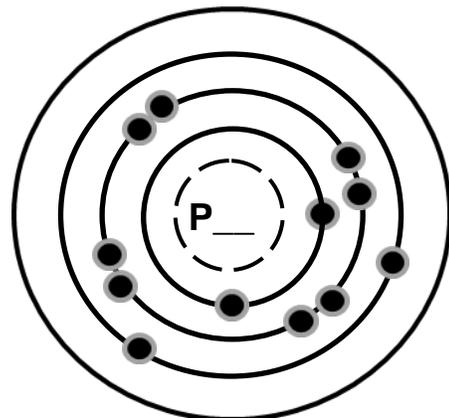
Who am I? _____



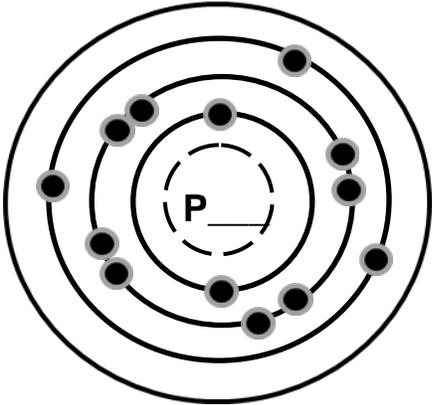
Who am I? _____



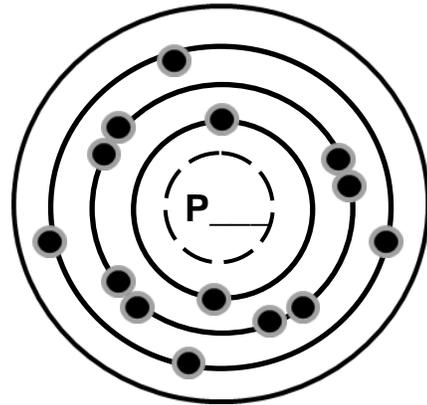
Who am I? _____



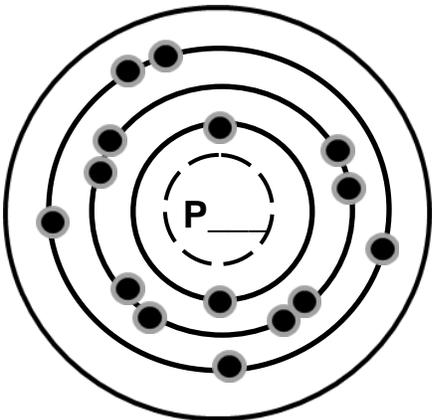
Who am I? _____



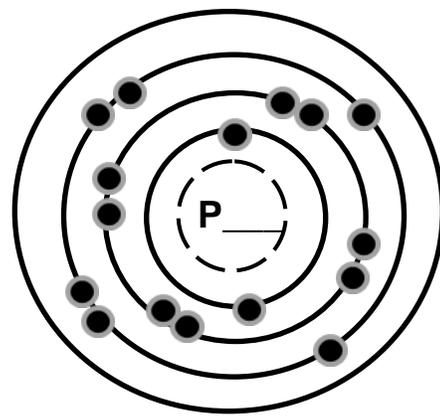
Who am I? _____



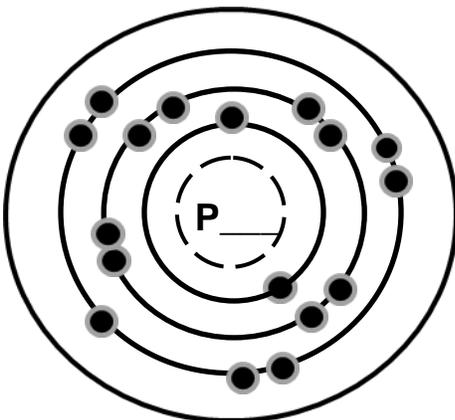
Who am I? _____



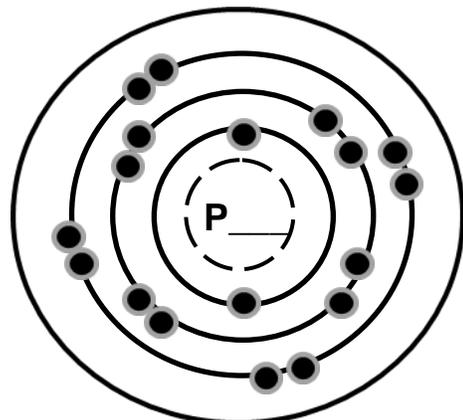
Who am I? _____



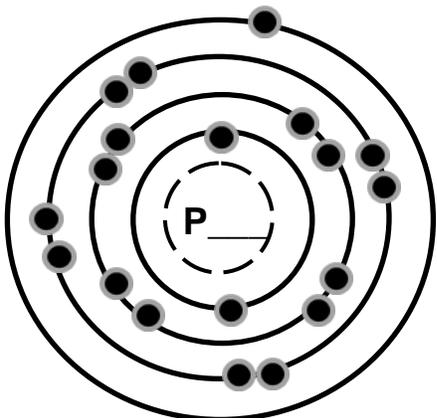
Who am I? _____



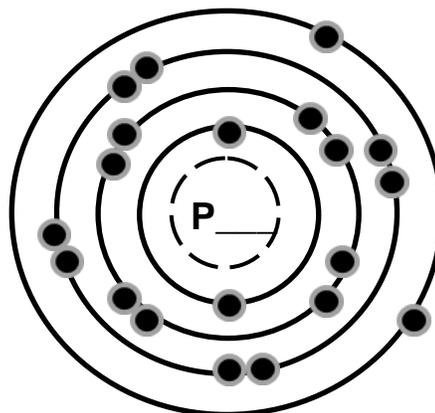
Who am I? _____



Who am I? _____



Who am I? _____



Two Column Notes

Periodic Table Organization

Periodic Table	
What is it?	
How is it organized?	
What does it predict?	
Valence Electrons	
What are they?	
Where are they?	
What do they do?	
Reactivity	
What is it?	
What makes an element reactive?	
What are the most reactive groups of metals?	
What are the most reactive groups of nonmetals?	
Groups	
Which direction do they go?	
How are they numbered?	
What is their pattern?	

Organization	
What are the names and numbers of the groups that are metals?	
What are the names and numbers of the groups that are nonmetals?	
What are the names and numbers of the groups that contain metalloids as well as metals and nonmetals?	
What is the name and number of the group that contains gases only?	
Periods	
Which direction do they go?	
How are they numbered?	
What is their pattern?	

Match the Elements

Examine the following table that is set up like the periodic chart. Use the table below to answer the questions that follow.

									M
A									
L									
			B			P			

1. Which elements have the same number of electrons in the outer shell?

2. What are the electrons in the outer shell called?

3. Which elements are in the same group?

4. Which elements are in the same period?

5. Which element(s) would be considered to be metals?

6. If the atomic number of Element M is 15, what is the atomic number of element A?

Match the Elements **KEY**

Examine the following table that is set up like the periodic chart. Use the table below to answer the questions that follow.

									M
A									
L									
			B			P			

1. Which elements have the same number of electrons in the outer shell? **A and L**

2. What are the electrons in the outer shell called? **Valence electrons**

3. Which elements are in the same group? **A and L**

4. Which elements are in the same period? **B and P**

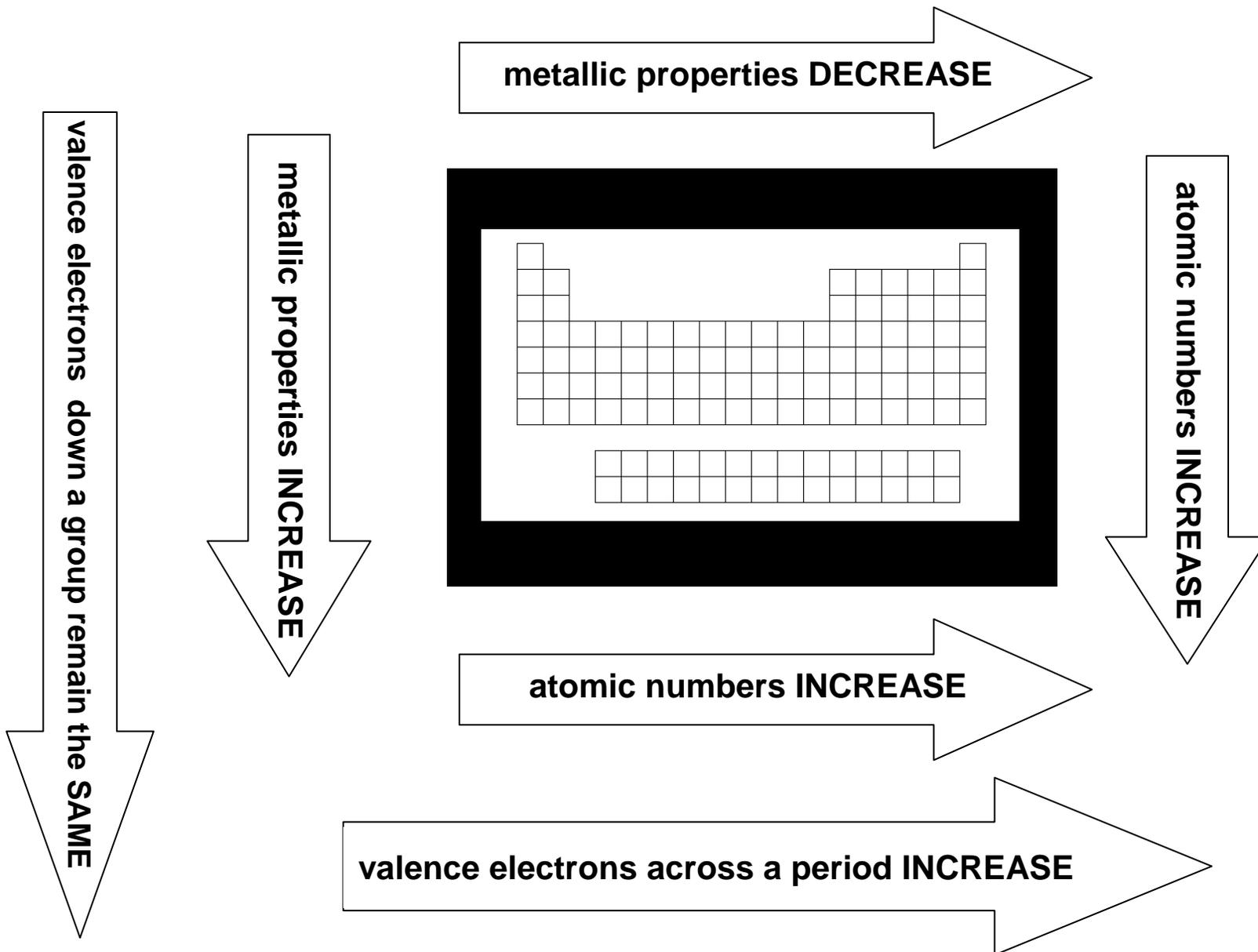
5. Which element(s) would be considered to be metals? **A, L, B, P**

6. If the atomic number of Element M is 15, what is the atomic number of element A? **16**

Brief History of the Periodic Table

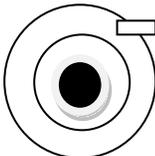
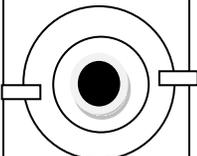
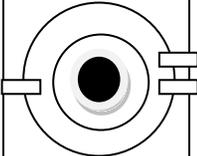
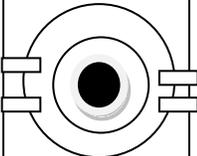
When	Who	What
1649	Hennig Brand	Made the first scientific discovery of an element (phosphorus).
1817	A.E. Beguyer de Chancourtois	Listed elements on a cylinder in order of increasing atomic mass.
1862	Johann Dobereiner	Proposed there were triads of three elements in nature with the mass of the middle element being the average of the other two (Law of Triads).
1863	John Newlands	Classified the 56 known elements into a table with 11 groups based on properties. He proposed that any element will behave similar to the 8 th element following it (Law of Octaves).
1864	Lothar Meyer	Developed a shortened version of the table only showing half of the known elements. Elements were listed in order of atomic mass and differences in behavior were due to mass. He published a longer version in 1869 but it wasn't published until 1870.
1869	Dmitri Ivanovich Mendeleev	Rearranged elements in order of their properties. He showed a vertical, horizontal, and diagonal relationship between the 63 known elements.
1895	Lord Rayleigh	Discovered argon and found it didn't fit in the current groups. In 1898 he proposed a new group to be called zero group because argon was unreactive (inert).
1911	Ernest Rutherford	Studied nuclei which led to the concept of nuclear charge.
1913	Henry Mosely	Published results of x-ray wavelengths of elements which proved the elements are in order of atomic number.
1940	Glenn Seaborg	Discovered plutonium and all elements from 94-102. He moved the Lanthanides and Actinides below the table.

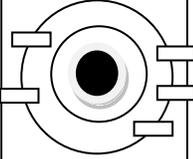
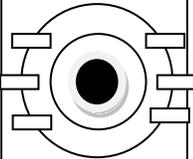
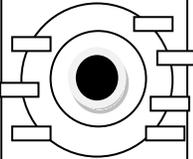
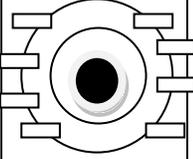
Periodic Trends



Valence Electrons and Energy Levels

Use the diagrams below, your knowledge of valence electrons, and the periodic table to complete the chart.

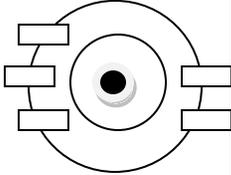
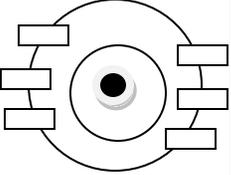
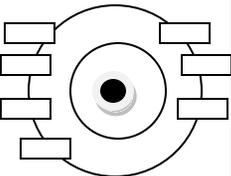
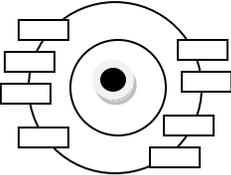
Element	Atomic Number	Group Number	Period Number	Metal, Non-Metal, Metalloid, Noble Gas	Number of Valence Electrons	Number of Energy Levels	Atom Model
							
							
							
							

Element	Atomic Number	Group Number	Period Number	Metal, Non-Metal, Metalloid, Noble Gas	Number of Valence Electrons	Number of Energy Levels	Atom Model
							
							
							
							

Valence Electrons and Energy Levels **KEY**

Use the diagrams below, your knowledge of valence electrons, and the periodic table to complete the chart.

Element	Atomic Number	Group Number	Period Number	Metal, Non-Metal, Metalloid, Noble Gas	Number of Valence Electrons	Number of Energy Levels	Atom Model
Lithium	3	1	2	Metal	1	2	
Berilium	4	2	2	Metal	2	2	
Boron	5	13	2	Metalloid	3	2	
Carbon	6	14	2	Non-Metal	4	2	

Element	Atomic Number	Group Number	Period Number	Metal, Non-Metal, Metalloid, Noble Gas	Number of Valence Electrons	Number of Energy Levels	Atom Model
Nitrogen	7	15	2	Non-Metal	5	2	
Oxygen	8	16	2	Non-Metal	6	2	
Fluorine	9	17	2	Non-Metal	7	2	
Neon	10	18	2	Non-Metal/Noble Gas	8	2	

Riddle Me This...

Use the periodic table and the clues listed below to solve the riddle. Write the name and symbol of the mystery elements.

1. _____ This element is the only metal found along the zigzag line.
2. _____ This element has similar chemical properties as oxygen, more protons than neon, but fewer than argon.
3. _____ This element has the most electrons in period 5.
4. _____ This element has one valence electron, but is not a metal.
5. _____ This liquid metal has more protons than gold, but fewer electrons than thallium.
6. _____ This element has an atomic number smaller than magnesium and 3 electrons in its valence shell.
7. _____ This gaseous element has 5 valence electrons and fewer neutrons than sodium.
8. _____ This very reactive nonmetal element has the most protons in the halogen group.
9. _____ This element has three energy levels and properties of metals and non-metals.
10. _____ This element has the fewest valence electrons in period 2.
11. _____ This element has 2 valence electrons and 4 energy levels.
12. _____ This precious metal has 32 more electrons than silver.
13. _____ This element is the only element in its group that is shiny, malleable, and a good conductor of heat and electricity. It has a higher atomic number than cesium, but lower than radon.
14. _____ This liquid non-metal has the same number of energy levels as calcium, fewer valence electrons than the noble gases, but more atomic mass than selenium.
15. _____ This element has the lowest atomic number in period 3.

Riddle Me This... KEY

Use the periodic table and the clues listed below to solve the riddle. Write the name and symbol of the mystery elements.

1. **Aluminum Al** This element is the only metal found along the zigzag line.
2. **Sulfur S** This element has similar chemical properties as oxygen, more protons than neon, but fewer than argon.
3. **Xenon Xe** This element has the most electrons in period 5.
4. **Hydrogen H** This element has one valence electron, but is not a metal.
5. **Mercury Hg** This liquid metal has more protons than gold, but fewer electrons than thallium.
6. **Boron B** This element has an atomic number smaller than magnesium and 3 electrons in its valence shell.
7. **Nitrogen N** This gaseous element has 5 valence electrons and fewer neutrons than sodium.
8. **Astatine At** This very reactive nonmetal element has the most protons in the halogen group.
9. **Silicon Si** This element has three energy levels and properties of metals and non-metals.
10. **Lithium Li** This element has the fewest valence electrons in period 2.
11. **Calcium Ca** This element has 2 valence electrons and 4 energy levels.
12. **Gold Au** This precious metal has 32 more electrons than silver.
13. **Bismuth Bi** This element is the only element in its group that is shiny, malleable, and a good conductor of heat and electricity. It has a higher atomic number than cesium, but lower than radon.
14. **Bromine Br** This liquid nonmetal has the same number of energy levels as calcium, fewer valence electrons than the noble gases, but more atomic mass than selenium.
15. **Sodium Na** This element has the lowest atomic number in period 3.

Evaluate Instructions PI

Performance Indicator

- Create an advertisement, written from the perspective of a period or group, for a new element to add to the periodic table. Include a response from an element indicating what properties it possesses that allows it to fit within the trends of the period or group.

(8.2E; 8.5B, 8.5C)

ELPS 1E; 5D, 5G

1. Instruct students to create an advertisement or want ad from the perspective of a period or group for a new element.
2. Explain that they need to include a response from the element indicating what properties it possesses that allows it to fit in with the trends of the period or group.
3. Instruct students to draft their ideas for their element ad in their science notebooks before creating the advertisement.
4. Share the Performance Indicator rubric or expectations with students prior to students beginning the assessment.
5. Answer any questions students may have regarding the assessment.