

Atomic Avengers

Lesson Objectives

- Classifying elements as metals, nonmetals, or metalloids based on their physical and chemical properties or position on the periodic table.
- Name and describe properties of groups in the periodic table, integrating periodic trends and electron configuration.
- Write chemical formulas and names for binary molecular compounds
- Draw Lewis dot structures for common molecules including single, double, and triple bonds
- Differentiate between polar and nonpolar covalent bonds
- Identify a compound as ionic or covalent from its chemical formula
- Identify ionic, and polar and nonpolar covalent bonds between atoms using:
 - position in the periodic table and electronegativity trends
- Use real world experience to make curriculum relevant
- Differentiate stereotypes vs. norms

Next Generation Science Standard:

SC.912. N.4.1

Explain how scientific knowledge and reasoning provide an empirically based perspective to inform society's decision making.

SC.912. P.8.5 (Level 2)

Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.

SC.912.N.1.1 (Level 3)

Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Pose questions about the natural world, Conduct systematic observations, Examine books and other sources of information to see what is already known, Review what is known in light of empirical evidence, Plan investigations, Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), Pose answers, explanations, or descriptions of events, Generate explanations that explicate or describe natural phenomena (inferences), Use appropriate evidence and reasoning to justify these explanations to others, Communicate results of scientific investigations, and Evaluate the merits of the explanations produced by others.

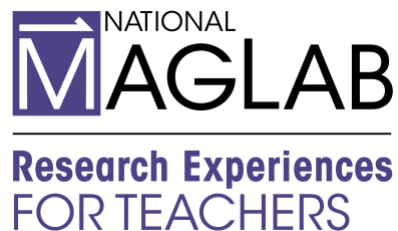
SC.912.P.8.7 (Level 2)

Interpret formula representations of molecules and compounds in terms of composition and structure.

STEM Rationale for Lesson:

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STEM Lesson Plan:



Students will use their knowledge of Unit 2: “How is Matter Constructed?” to advance your understanding of Unit 3: “How Do Chemicals Interact?”. Throughout this lesson students will complete a series of tasks to develop an Atomic Avenger- a superhero or villain inspired by a known element. The activity involves 3 phases:

- **Phase 1:** Investigating the properties of the chosen element and utilizing ELA standards to create backstory for the Avenger
- **Phase 2:** Applying the results of their research, and incorporating the concept of valence electrons as well as the atomic number to design a uniform for their Avenger
- **Phase 3:** Collaborating with peers to investigate ionic and covalent compounds using their avengers.

Culturally responsive connection:

One goal of my lesson was to use real world experience to make the curriculum more engaging. I chose the opening activity to introduce the role of stereotypes vs. norms- the gossip and text in the activity compared to stereotypes vs the norm of high school students. The lesson addressed the stereotypes vs the norms of chemists/STEM professionals. We evaluated photos of scientists that we have been required to study thus far. We discussed some possible stereotypes of STEM based solely on the individuals that we have studied, as well as the current norms in STEM. Finally, I put the ball in their court to break the stereotypes in chemistry/STEM and allow them to become the scientist. Each student is responsible for developing an Atomic Avenger that reflects the properties and qualities that the element that they were randomly assignment and see themselves in STEM.

Materials Needed:

Provided by Teacher:

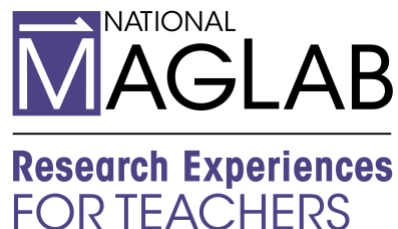
1. Chemistry Gossip Worksheet (see Appendix A)
2. Atomic Avenger template (see Appendix B)
3. Atomic Avenger Nearpod (<https://nearpod.com/>)
4. Art supplies
5. Construction Paper
6. Atomic Avengers Phase III Worksheet
7. Laptop/chromebook

Activate Prior Knowledge:

1. The development of Mendeleev’s periodic table, including:
2. Periodic Law- a repeating pattern of chemical and physical properties among elements
3. Differentiation of elements as metals, nonmetals, or metalloids
4. Difference between physical and chemical properties and physical and chemical changes of matter.
5. Periods represent the energy level of the outer most electrons for an atom
6. Group numbers represent the number of valence electrons of an atom
7. Names and properties of groups 1, 2, 17, and 18

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STEM Lesson Plan:



Lesson Introduction:

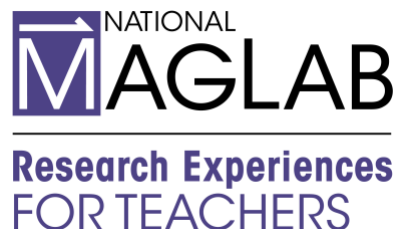
1. Students will begin with bell work document “Chemistry Gossip”
 2. The bell work slide will instruct students to use their personal periodic tables to complete the assignment. Students have 10 minutes to complete it.
 3. At the end of the allotted bell work time, students will be asked compare & contrast stereotypes vs. norms
 4. Students unpack the following question, “How does the gossip and text in the activity compared to stereotypes vs the norm of high school students?”
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Lesson Activity:

1. Students will be given a Nearpod code to participate in the lesson
 2. Student will access Nearpod via Canvas or Nearpod.com
 3. Students will see the following question as the intro slide, “One way to make our content more attainable is to relate it to real world experiences. How did today’s bell work do that?”. They will have 2-3 minutes for a class discussion.
 4. The next slide instructs students to turn to a neighbor & share common stereotypes associated with scientists and answer the following question: How do the stereotypes compare to the norms of science?
 5. Students have 3 minutes to discuss
 6. Students will document their responses on the open-ended question slide in Nearpod.
 7. Advance student screens to the next slide. This slide shows images of 4 scientists. Invite students to identify the scientists pictured, “Do you recognize any of the scientists pictured here?”
 8. Next ask, “what do they all have in common?”
 9. Follow up question, “ what would this slide lead you to believe about chemistry?”
 10. Advance the slide. Allow students to submit their responses on the Nearpod collaborate board. Remind students to like responses on screen. Discuss some of the responses.
 11. Advance student screens to the next slide- Student Poll: “ Are you interested in a career in Science, Technology, Engineering or Math (STEM)?”
 12. Discuss poll results and advance to next slide.
 13. Next slide reveals an array of scientists with diverse nationalities and genders. Invite students to identify the scientists pictured, “Do you recognize any of the scientists pictured here?”
 14. Identify each scientist and their contribution to STEM
 15. Ask the following question: What does this slide lead us to believe about current norms in STEM? Allow time to discuss
 16. State: “ So far this lesson addressed the stereotypes vs the norms of chemists/STEM professionals. We evaluated photos of scientists that we’ve been required to study thus far. We discussed some possible stereotypes of STEM based solely on the individuals that we have studied, as well as the current norms in STEM. Now the ball is in your court to break the stereotypes in chemistry/STEM. The class poll results showed over____% of you are interested in a career in STEM. You can start right now!
 17. Advance slides to show the opening slide for Atomic Avengers
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STEM Lesson Plan:



Lesson Assessment

Criterion: Storyline

The story line needs to describe the inception of your Atomic Avenger, his or her purpose, where they reside, and of course a name for your Atomic Avenger. In this process you will also describe your Atomic Avenger's alter ego, how they maintain their identity, any weaknesses, as well as how their powers are invoked. This portion of your project must meet the following requirements:

Grammatically correct

One-page max Typed size 12 font

Double spaced

Imaginative

Point range 1-5

Criterion: Phase II- Character Development

Congratulations- you've just created your Atomic Avenger! Provide additional character details by answering the following questions:

What superpowers does your Atomic Avenger possess?

Is your Atomic Avenger a hero or villain? Explain.

Point range 1-5

Criterion: Phase II: Character Design Overall

What is a superhero without a uniform to represent the essence of their capabilities? In this phase you will design your Atomic Avenger's uniform. Use the template provided to create the appearance of your Atomic Avenger. The uniform must reflect the following:

Elemental properties- physical & chemical

Element's atomic number

The number of valence electrons

Any unique characteristics of the element

Must be in color

Point range 1-5

Criterion: Phase II Character Design - Atomic Number

The element's Atomic Number is creatively integrated into the Atomic Avenger's appearance.

Point range 1-5

Criterion: Phase II Character Design- Valence Electrons

The element's proper number of valence electrons is creatively integrated into the Atomic Avenger's appearance.

Point range 1-5

Criterion: Phase II Character Design- Size

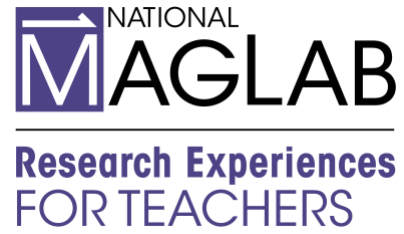
Your superhero may be larger but NOT smaller than the template. Feel free to enhance your design with added materials.

Point range 1-5

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Appendix A



Chemistry Gossip

Write the chemical symbols for the elements found in each question.

1. I bet that outfit is made of Copper and Tellurium, because it is so...

2. Did you hear that Oxygen is going out with Magnesium?

3. Sulfur, Tungsten, and Silver, they've got so much...

4. Are you friends with Nitrogen and Oxygen?

5. I saw Sulfur, Uranium, and Phosphorus and asked...

6. Ruthenium saw Oxygen and Potassium and asked...

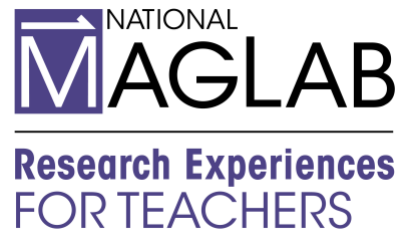
7. Have you heard? Lutetium and Vanadium are in...

8. Hydrogen and Iodine really know how to get a conversation going...

9. I heard that Sulfur was going out with Oxygen, but then Tungsten, Hydrogen, and Astatine were like...

10. I guess I'll TTYL, Atomic Number of Beryllium, Sulfur, Uranium, Rhenium.

National MagLab STEM Lesson Plan:



Appendix B

National MagLab STEM Lesson Plan:



Atomic Avengers Phase III

1. After the Gallery Walk & presentations I believe

_____ could debilitate
my Atomic Avenger due to these 3 facts:

A. _____

B. _____

C. _____

2. I select _____,

_____ and

_____ to form my

Avenger Team/ Villain (circle one).

3. Our combined powers will create (complete below) to save
humanity/ conquer the world:

4. Lewis Dot Structure for each Atomic Avenger in our group:

