Unit 3

Physical Science: Atoms, Elements, and Compounds

Ms. Li

Sc9/E

**Prior skills and knowledge:** Students have covered Kinetic Molecular Theory, chemical families, and the Bohr Model. The electricity unit was also covered earlier on in the year. The last time I was with the class, some had trouble getting along with other students, 2 students were very welcoming of challenge, some students struggled with working out problems (Math class), and most were very capable with independent work.

**Prescribed learning outcomes:**

**C1** use modern atomic theory to describe the structure and components of atoms and molecules

**C2** use the periodic table to compare the characteristics and atomic structure of elements

**C3** write and interpret chemical symbols of elements and formulae of ionic compounds

**C4** describe changes in the properties of matter

**Big Ideas and Skills learned at end of unit**

1. Classify natural changes in our environment as physical or chemical changes
2. Relate element properties with their atomic make-up and their position on the periodic table
3. Draw and use Bohr models to identify elements, ions, and ionic compounds
4. Write compound names and chemical formulas of ionic compounds
5. Explain how ionic compounds are creating using the periodic table

**Vocabulary:** alkali metal, alkaline earth metal, atom, atomic mass, atomic number, Bohr model, conductivity, covalent compounds, density, electron, element, halogens, ionic compounds, mass, melting/boiling point, molecule, multiple ion charge, metal, metalloid, neutron, noble gases, non‐metal, polyatomic ions, proton, state, subatomic particles, volume

**Student Development Goals (Ideal student)**

1) Highly motivation to learn, not for marks or grades but for:  
 a) personal interest -> develop interests that matter to them  
 b) natural thirst for knowledge  
 c) applications to real world  
 d) connections made to international/global issues

3) Responsibility over learning and personal development

4) Mastery of skills to do well in the workforce  
 a) collaboration/teamwork  
 b) computing  
 c) leadership  
 d) creativity  
 e) critical thinking

5) Find meaning in their learning through:  
 a) projects  
 b) research

6) Willingness to experiment, taking risks, and challenging themselves

**Assessment**

1. Participation (engagement in classroom activity, class handouts, reflections, assignments, and presentations - no marks, feedback only) - 40%
2. Quizzes - 20%
3. Unit Test - 40%

**Materials:** laptop, projector, and quiz/pre-quiz/unit test/problems handouts, Escape room challenge, Phorgum challenge cards, Instasnow

**Extensions:** PhET, Youtube videos, game challenge

**Cool Videos**

Quantum levitation

https://www.youtube.com/watch?v=Ws6AAhTw7RA&feature=youtube\_gdata\_player

Slinky Drop  
https://www.youtube.com/watch?v=wGIZKETKKdw

**Total lessons:** 12 lessons **Total time:** 16hrs

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| --- | --- | --- | --- | --- |
| Lesson | Activities | Materials and Extensions | Learning Objectives | Assessment |
| 1 | **1) Class intro, social norms/expectations, goal setting**  **2) Inquiry - Undemo with InstaSnow**  (Physical and chemical changes)  **3) Article on InstaSnow (TEDideas)**  **HWK**  1) Read the TEDideas article and write your thoughts on the side of the article. Be prepared to share you thoughts next class.  2) Think of one chemical or physical change for the class to "eduguess". Make sure you can justify it yourself. | InstaSnow-http://www.stevespanglerscience.com/lab/experiments/insta-snow-polymer | **Learning objectives**   1. Understand and identify the differences between physical and chemical changes 2. Categorize natural and artificial processes as physical and chemical changes (ex. state changes) 3. Provide examples of chemical and physical changes   **BIs**   1. Classify natural changes in our environment as physical or chemical changes   **PLOs**  **C4** describe changes in the properties of matter  **Skills developed to meet development goals**   1. Self-directed learning 2. Critical thinking 3. Collaborative skills 4. Asking questions 5. Creativity | Inquiry Questions |
| 2 | **1) Reflection on article** - discussion  **2) Group activity** - have students share the change they thought of and the rest of the group tries to respond with chemical or physical change and justify it. Class is brought together to share which changes were the tricky ones.  **3) Teacher facilitated, student lead note taking** (an reflection on what students learned and questions they might still have) |  | **Learning objectives**   1. Understand and identify the differences between physical and chemical changes 2. Categorize natural and artificial processes as physical and chemical changes (ex. state changes) 3. Provide examples of chemical and physical changes   **BIs**   1. Classify natural changes in our environment as physical or chemical changes   **PLOs**  **C4** describe changes in the properties of matter  **Skills developed to meet development goals**   1. Critical thinking 2. Collaborative skills 3. Asking questions 4. Creativity 5. Leadership | Discussion  Group activity - class sharing  Student lead note taking - student ideas and reflection on what they learned |
| 3 | **1) Police constable guest speaker**  **HMK** - 3 things from the presentation that you:  1) Already knew  2) Thought was new and interesting (write as many as you need)  3) How will the 3 things above help you with your future |  | **Learning objectives**   1. Understand and identify the differences between physical and chemical changes 2. Categorize natural and artificial processes as physical and chemical changes (ex. state changes) 3. Provide examples of chemical and physical changes   **BIs**   1. Classify natural changes in our environment as physical or chemical changes   **PLOs**  **C4** describe changes in the properties of matter  **Skills developed to meet development goals**   1. Critical thinking 2. Asking questions 3. Self-reflection | Guest speaker handout |
| 4 | **1) Debrief on guest speaker** (collect HMK)  - What did you think?  - Did it help you? Where you grateful they were able to come in?  - How can we express this?  **2) Brainstorming differences and similarities between ionic and covalent compounds**  - Group work then team teach  - Every group must share something different  **3) Inquiry into chemical formulas**  - Why do we have NaCl but not NaCl2? (Example question)  - Students are provided with a list of standardized chemical formulas and offered alternative formulas that do not exist. Their purpose is to explain why these alternative formulas do not exist  - Groups work on an explanation  - Groups merge to team-teach. This continues until the class is one group. Every students writes down what their group concluded at the end of each merging process.  HMK - complete their progress report on the conclusions generated by the groups. Have students write down briefly why they were told to write conclusions at the end of each group merge. | Game  https://itunes.apple.com/us/app/school-dragons-alchemy-adventure/id885038943?ls=1&mt=8  **Introduce challenge -**  **1) Find the scientific error in this game**  **2) Suggest ways to improve this game. The new idea must improve BOTH the education and the entertainment experience of the game.** *Deadline: day of Unit Test* | **Learning Outcomes:**   1. Recognize and correct mistakes in chemical formulas of ionic compounds 2. Construct ionic compounds from at least 2 different elements 3. Understand that elements are made of the same atom, while compounds are made of at least 2 different atoms, thus elements   **Big Ideas and skills**   1. Write compound names and chemical formulas of ionic compounds 2. Explain how ionic compounds are creating using the periodic table   **PLOs:**  **C3** write and interpret chemical symbols of elements and formulae of ionic compounds  **Skills developed to meet development goals**   1. Self-directed learning 2. Critical thinking 3. Collaborative skills 4. Asking questions 5. Creativity 6. Leadership | Conclusions reached in groups |
| 5 | **1) Debrief on inquiry last class.** Each student hands in progress report.  **2) Teacher facilitated, student lead note taking** (a reflection on what students learned and questions they might still have)  - Writing chemical formulas - what about multivalent and polyatomic ions?  - How might you draw ions in their Bohr model? - Can have class try and bring it together  **3) Group work**  Students work in groups to come up with 5 questions and pick the top 3. Students in group work on the different questions to hand in at the end of class. Teacher projects learning outcomes to make sure students cover.  **4) Video on history of the atom** | https://www.youtube.com/watch?v=thnDxFdkzZs | **Learning Outcomes:**   1. Recognize and correct mistakes in chemical formulas of ionic compounds 2. Draw Bohr models for ionic compounds written in their chemical formulas 3. Construct ionic compounds from at least 2 different elements 4. Describe the discoveries that shaped the model of the atom   **Big Ideas and skills**   1. Write compound names and chemical formulas of ionic compounds 2. Explain how ionic compounds are creating using the periodic table   **PLOs:**  **C3** write and interpret chemical symbols of elements and formulae of ionic compounds  **Skills developed to meet development goals**   1. Self-directed learning 2. Critical thinking 3. Collaborative skills 4. Asking questions 5. Creativity 6. Leadership | Progress report from inquiry session  Student lead note taking - student ideas and reflection on what they learned  Student generated questions and responses |
| 6 | **1) Quiz** - at least 1 question is chosen from student responses from the previous day.  **2) Bohr and PhET - computer lab**  Inquiry worksheet and games - students will be working with a partner. This is to be handed at the end of the day. |  | **Learning Outcomes:**   1. Use the periodic table to describe and calculate the make-up of atoms, including the number of protons, neutrons, and electrons 2. Draw Bohr models of the first 20 elements in their neutral and ionic form 3. Explain the formation of ions using the stable configuration of noble gasses   **Big Ideas**   1. Relate element properties with their atomic make-up and their position on the periodic table 2. Draw and use Bohr models to identify elements, ions, and ionic compounds   **PLOs:**  **C1** use modern atomic theory to describe the structure and components of atoms and molecules  **C2** use the periodic table to compare the characteristics and atomic structure of elements  **Skills developed to meet development goals**   1. Critical thinking 2. Collaborative skills 3. Asking questions | Quiz  Inquiry worksheet |
| 7 | **1) Quick notes on naming**  **2) Inquiry lab**  Students are provided all the materials they may need. Students group themselves into groups of 3 to 4. Using the materials, they brainstorm and design a research question that looks at properties of matter. They are encouraged to think of questions that may relate to trends on the periodic table. They make sure they leave with a hypothesis, a prediction, and materials they need for the experiment. Make sure to tell students that there is no right question and prediction. Make sure students leave the class copying down all the safety precautions of the chemicals they will be using. Students must prepare their list of procedures and a pre-made data table before next class. | -Rulers  -Beakers  -Graduated Cylinders  -Voltmeters  -Ammeters  -Wire  -Electric balance  -Stop Watch  -Various metals  -Various chemicals  -Googles  -Presentation rubric | **Learning Outcomes:**   1. Describe the properties of matter such as its mass, volume, density, color, state, and conductivity 2. Differentiate between elements and compounds   **PLOs:**  **C4** describe changes in the properties of matter  **Skills developed to meet development goals**   1. Self-directed learning 2. Critical thinking 3. Collaborative skills 4. Asking questions 5. Creativity 6. Implementation 7. Leadership | Student brainstorming of research questions |
| 8 | **1) Inquiry lab**  Students hand in a copy of their procedures including the safety precautions they must take. The rest of the class is dedicated to performing the lab. They need to make sure they take some photos during the lab to help them prepare for their upcoming presentation. | -Rulers  -Beakers  -Graduated Cylinders  -Voltmeters  -Ammeters  -Wire  -Electric balance  -Stop Watch  -Various metals  -Various chemicals  -Presentation rubric | **Learning Outcomes:**   1. Describe the properties of matter such as its mass, volume, density, color, state, and conductivity 2. Differentiate between elements and compounds   **PLOs:**  **C4** describe changes in the properties of matter  **Skills developed to meet development goals**   1. Self-directed learning 2. Critical thinking 3. Collaborative skills 4. Asking questions 5. Creativity 6. Implementation 7. Hands-on 8. Leadership | Skills and safety used during the lab  Students will present their findings in 2 classes as well hand in their reflection. |
| 9 | **Challenge day!**  **1) Escape room** - Class divides students into 3 groups. Any student can choose to opt out. Groups rotate to go inside the room.  **2) Phorgum challenge** - groups in the classroom work on putting together a periodic table from a new set of elements and their properties | Escape room  Phorgum cards and handout | **Learning Outcomes:**   1. Use the trends in the periodic table to predict the properties of elements with respect to their group (alkali, alkaline, halogens, noble gas, metal, non-metal, and metalloids) 2. Use KMT to explain state changes using concepts of temperature and density in your explanation 3. Categorize natural and artificial processes as physical and chemical changes (ex. state changes) 4. Use the periodic table to describe and calculate the make-up of atoms, including the number of protons, neutrons, and electrons 5. Draw Bohr models of the first 20 elements in their neutral and ionic form 6. Explain the formation of ions using the stable configuration of noble gasses 7. Recognize and correct mistakes in chemical formulas of ionic compounds 8. Draw Bohr models for ionic compounds written in their chemical formulas 9. Construct ionic compounds from at least 2 different elements   **Big Ideas**   1. Classify natural changes in our environment as physical or chemical changes 2. Relate element properties with their atomic make-up and their position on the periodic table 3. Draw and use Bohr models to identify elements, ions, and ionic compounds 4. Write compound names and chemical formulas of ionic compounds 5. Explain how ionic compounds are creating using the periodic table   **PLOs:**  **C1** use modern atomic theory to describe the structure and components of atoms and molecules  **C2** use the periodic table to compare the characteristics and atomic structure of elements  **C3** write and interpret chemical symbols of elements and formulae of ionic compounds  **C4** describe changes in the properties of matter | Progress on Escape room and Phorgum challenge |
| 10 | **Review session and presentations**  **1) Presentations for the inquiry lab** - each group gets 5 mins each to present their question, findings, and conclusions  **2)** **Group work** (groups of 5 students)- students look at all the learning objectives and design 10 questions as a group. Each group chooses the top 5 questions and each student completes a different question. The questions without the answers are passed to another group and they answer the same questions as a group. The questions rotate through the groups as each group attempts the questions. The questions and answers go back to the first group and they assess and give feedback to the responses as a group. The groups get their feedback on their questions and all the questions are handed in at the end of class. *The quiz next session and the unit test will have at least 1 question from the questions generated by the class.* |  |  | Presentation from the groups  Questions and responses generated. |
| 11 | **Review session 2**  **1) Quiz**  **2) Study session**  **3) Quiz returned** |  |  | Quiz |
| 12 | **Unit Test** |  | Students are allowed to bring in a double-sided 8.5" to 11" paper of their own **HANDWRITTEN** notes. Pre-warn the students that writing this piece of paper is not enough to help them do well on this unit test because most questions are concept-based where they must understand and be able to apply the material they learned. | Unit Test |