| Lesson 1-6: Structure & Properties of Matter | |
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| **Curriculum Expectations** | • C2.1<br>• C2.5<br>• C2.6<br>• C3.4 |
| **Learning Goals** | **Learning Goals:**<br><br>By the end of this lesson you will:<br><br>• Describe the different intermolecular forces that hold molecules of a substance together.<br>• Understand how those intermolecular forces influence the properties of matter.<br>• Describe different types of solids based on their properties. |
| **Success Criteria** | **Success Criteria:**<br><br>I know I have achieved the learning goals when I can relate the properties of different types of matter to their structures. |
| **Teacher Prep** | • Check that video in 1-6A is working<br>• Check that intermolecular forces – States of Matter Simulator works (1-6B)<br>• Check that interactive element in 1-6D is working<br>• Check that interactive element in 1-6G is working – it is recommended that the teacher go through this interactive to become familiar with how to use and complete the tasks within. |

## Minds On

Goal: This activity will allow students to be able to visualize the tug-of-war for electrons that occurs between atoms within the same molecule.

**1. <u>Intermolecular Forces Think-Pair-Share</u>**

**Instructions:**

**Prompt Question:** What happens to the molecules of a compound when a change of state occurs from a solid to a liquid?

1. Have students carefully think about the prompt for 2 minutes. Ask them to think about how they would answer the question and what connections there are to their previous knowledge.
2. Pair students up and have them share their ideas and discuss the prompt for 3-5 minutes. Asking questions to clarify their thinking.
3. The pair chooses one member to share their ideas with the class.
4. Lead a class discussion after introducing the idea that changes occur on a molecular level when changes of state occur.

## Action

****Refer to the Differentiation Resources link for additional practice worksheets, and to enrich your classroom teaching using different tools throughout the lesson. ****

1. **Structure & Properties of Matter Worksheet**
    - Have students complete the handout as they work their way through the lesson *or* you can assign the handout as homework to completed after class and taken up in the next session.

2. **1-6A: Intermolecular Forces:**
    - Have students read through the introduction on their own.
    - View the video together as a class.
    - Lead a class discussion about the video, focusing on the differences between inter and intramolecular forces. Its important to emphasize the difference in strength between intra and inter.
    - Have students read through sections C & D on their own.
    - Use the images from the activity and display them for the class to see.
    - Review the content as a class, emphasizing the differences between the types of intermolecular forces, including how they form and their relative strength differences.

3. **1-6B: Intermolecular Forces & States of Matter Simulator**
    - This activity can be completed by students individually or together as a class.
    - Before completing the worksheet have students explore the simulator for 5 minutes, testing out the different features and exploring the different measures.
    - Address any misconceptions or technical problems with the simulator before students complete the worksheet.
    - After completion, take up the answers as a class.
    - Emphasize the motion and organization of molecules in their different states.

- This is a good opportunity to work on observation skills, drill down in your questioning to make sure the students are making detailed observations.

4. **1-6C: Intermolecular Forces Investigation**
   The purpose of this investigation is to have students link intermolecular forces and changes of state. They should be able to use their current knowledge to predict the trends in boiling points. Before they make their predictions, discuss how the strength of intermolecular forces may vary depending on the size and nature of the molecules.
   - Before they graph the results have students share their predictions and discuss the merits and reasoning underlying them.
   - Have students complete the graphs individually. This is a good opportunity to practice graphing using proper formatting (labeled axis', graph title, units, scale, accuracy)
   - Have students share their graphs with each other, offering feedback on format and content.

5. **1-6D: Physical Properties of Matter**
   - Students will read each section individually, followed by a class review and discussion.
   - Points of emphasis is that different types of bonding and organization produces different physical properties.
   - The strength of the forces holding molecules together effects boiling and melting points.
   - Electrical conductivity and sheen are related to the ability of electrons to move freely within a solid.
   - The interactive embedded in the activity can be done individually or as a class.

6. **1-6E: Properties of Materials Virtual Lab**
   This is a good tool to help consolidate information relating to physical properties and intermolecular forces. Students should complete the lab individually. The teacher should circulate and help deal with any technical or content related problems.

## Consolidation

1. **1-6F: Physical Properties of Solids Worksheet.** This activity allows students to further explore and consolidate their knowledge of intermolecular forces and their effects on the properties of matter. This can be completed individually in class or at home. Answers should be taken up as a class the following day.

2. **1-6G: Quiz** – To be completed individually, in class or at home. It is advised to do one example with the whole class to help practice how to answer these questions. Take up the answers together the following day.

3. **1-6I: Green Chemistry Product Pitch Assignment -** This is a graded activity. Review the expectation with the whole class before the students attempt the assignment. Emphasize where the marks are allocated and review proper naming convention and file formats. It is a good idea to show students an example of a product pitch from a show such as Dragon's Den or an infomercial as a silly example. Emphasize that students should put in a lot of time and effort to receive a good grade and that creativity is important to help communicate effectively for this assignment.

****Refer to Differentiation Resources for additional practice worksheets, and to enrich your classroom teaching using different tools. ****