## Getting to the Core of Matter

### TEACHER NOTES

**NGSS Standards:**

<table>
<thead>
<tr>
<th>Scientific and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2nd Grade:</strong></td>
<td><strong>5th Grade:</strong></td>
<td></td>
</tr>
<tr>
<td>Analyzing and Interpreting Data</td>
<td>PS1.A: Structure and Properties of Matter</td>
<td>2nd Grade: Cause and Effect</td>
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<tr>
<td>Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</td>
<td>• Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)</td>
<td>• Events have causes that generate observable patterns. (2-PS1-4)</td>
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<tr>
<td>• Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)</td>
<td>PS1.B: Chemical Reactions</td>
<td>• Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)</td>
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<tr>
<td>Constructing Explanations and Designing Solutions</td>
<td>• Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)</td>
<td>5th Grade: Cause and Effect</td>
</tr>
</tbody>
</table>
| Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. | 2
| • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) | • Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4) |
| Engaging in Argument from Evidence | PS1.A: Structure and Properties of Matter | Scale, Proportion, and Quantity |
| Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). | • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1) | • Natural objects exist from the very small to the immensely large. (5-PS1-1) |
| • Construct an argument with evidence to support a claim. (2-PS1-4) | 4
| **5th Grade:**                      | PS1.A: Structure and Properties of Matter |                       |
| Developing and Using Models         | • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) |                       |
| Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. | 2
| • Use models to describe phenomena. (5-PS1-1) |                       |                       |

**Common Core State Standards Connections:**

- **2nd Grade: ELA/Literacy —**
  - RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4)
  - RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)
  - W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1-2),(2-PS1-3)
  - W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3)

- **5th Grade: ELA/Literacy —**
  - RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)
  - W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)
  - W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2),(5-PS1-3),(5-PS1-4)

### Materials:

- Alcohol swab
- Markers
- Ice
- Water
- Plastic rules
- Tape
- Plastic bottles with lids
Lesson Sequence:
1. Card Sort (use fan and pick)
2. Swab the Deck (what do we know about matter?)
3. Swab Balance
4. Article (circle and underline. What can we add about matter that we read?)
5. Leaky Soda
6. Writing to Learn
   a. Option 1
      i. Card Sort
      ii. I used to think but now I know
   b. Option 2
      i. Read the little tent that cried
      ii. Finish the story

Card Sort (Variation from Success in Science and Kagan Cooperative Learning)
1. Provide each group with a set of cards.
2. Number students 1 -4 in each group (this works the same in groups of 3 or 5 as well)
3. Student #1 holds cards in a fan and says to student #2, “Pick a card, any card!”
4. Student #2 picks a card, reads the statement aloud and allows five seconds of think time.
5. Student #3 decides if he/she agrees, disagrees or is not sure, explaining their reasoning. At this point, it is okay to guess.
6. Student #4 paraphrases why student #3 placed the card in that category. No changes should be made at this point. Student #4 is simply summarizing why student #3 placed the card in one of the piles.
7. Students rotate roles, one person clockwise until all cards are placed in a pile.
8. Once all cards are placed, teacher directs students to make sure every member of the group agrees with the placement of all 7 cards. Students should discuss and make changes as necessary.

Swab the Deck: Directions on worksheet
• Discussion after lesson
  o List observations on board
    ▪ students should notice that the rubbing alcohol disappeared. It went away a little at a time. The thinner parts went away first and the thicker parts took longer. They could smell the rubbing alcohol. It was strong at first, now not as strong of a smell.
  o Lead students to an inference about matter
    ▪ The rubbing alcohol is made of little bits and that is why it disappeared a little at a time.
    ▪ All stuff, or matter, is made of bits. We will call these particles. (We don’t have to know exactly what these particles are made of or what they look like, but we can agree that things are made of smaller parts)
    ▪ We know the rubbing alcohol still exists because we could smell it. (even though we don’t know where it is. Students may question if it is in the table or the air or both)

Swab Balance: Directions on worksheet (can be done as a demo as well)
• Discussion after lesson
  o List observations on board
- Students should notice that the rubbing alcohol side went up (meaning it is lighter) and the empty side went all the way down to the table.
- It went up a little at a time even shaking a little back and forth maybe
- It moved without anyone touching it.
- The plastic ruler is dry
- They can smell the rubbing alcohol

- Lead students to an inference:
  - The rubbing alcohol did not go into the ruler. It went into the air. It still exists. This is called evaporation.

- Ideas for further testing if students are still questioning:
  - Pour a lot of rubbing alcohol on a table to see if the bottom of the table gets wet
  - Put rubbing alcohol on a table and cover with a plastic cup or plastic wrap to see if it dries out
  - Put the swab in a plastic bag
  - Test other student generated ideas

### Critical Reading (AVID and Kagan Strategies)

1. **Pre-reading:** Provide each student with an article. Have students look at pictures and source for 45 seconds. After the time, have students make a prediction about what the article is about. Students can write their prediction at the end of the reading.
2. **With a partner complete timed, pair share.** Partner A should share his/her prediction, partner B listens. Partner B responds with a positive response (“thanks for sharing;” “I hope your prediction comes true,” etc). Partners switch roles.
3. **As a class, number each paragraph (it may be helpful to read the first word of each paragraph and students respond with the paragraph number).**
4. **First Read:** Students read article individually and circle any key terms. Key terms include content/lesson based vocabulary, properties, formulas, units, etc.
   - *Examples: atoms, molecules, energy, condensation, evaporation, heating, cooling*
5. **Students should rally robin to share their ideas.** In Rally Robin, partner A says one term, partner B says one term and continue sharing for 1 minute. Students may or may not agree on all terms but most should be the same.
6. **Share key terms as a whole class.**
7. **Second Read:** Individually, students should re-read the article and underline essential ideas or claims.
   - *Example: “These atoms and molecules are always in motion.”*
8. **Rally Robin in pairs to share essential ideas.** Partner A shares one essential idea and partners discuss. Partner B shares one essential idea and partners discuss. Continue for 4 minutes.
9. **As a class, discuss and list a few of the essential ideas.**

### Card Sort Part 2/I used to think but now I know

1. Return to card sort ideas.
2. **In groups, have students re-sort cards based on their current understanding.**
3. Have each student pick one card that was changed after going through the lessons or that their group had a lengthy discussion about.
4. **Write the card on the top of the worksheet.** Complete the sentences “I used to think...Now I know...” Make sure to include a detailed explanation including pictures if needed.
5. **All students stand up.** Walk around and find a nearby partner not in their group. Partner A shares their understanding for 45 seconds. Partner B paraphrase, then switch roles. Partner B talks for 45 seconds, Partner A paraphrases. After sharing, both partners write 2-3 sentences on their partner’s ideas for 1 minute.
6. **Repeat step 5 with 2 other partners**
7. **Students return to seats and have 2 minutes to fix or add anything on their own paper.**
**Card Sort Directions:**

1. Student #1 holds cards in a fan and says to student #2, “Pick a card, any card!”
2. Student #2 picks a card, reads the statement aloud and allows five seconds of think time.
3. Student #3 decides if he/she agrees, disagrees or is not sure, explaining their reasoning. At this point, it is okay to guess.
4. Student #4 paraphrases why student #3 placed the card in that category. No changes should be made at this point. Student #4 is simply summarizing why student #3 placed the card in one of the piles.
5. Students rotate roles, one person clockwise until all cards are placed in a pile.
6. Once all cards are placed discuss and make changes as necessary until group is satisfied with place placement of cards.
7. Write agree/disagree/not sure on the back of each card. Keep safe for later use.
8. Group members high five!

<table>
<thead>
<tr>
<th>When water evaporates, it becomes the air</th>
<th>Condensation is when air becomes a liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water only evaporates from oceans and lakes</td>
<td>Evaporation is when a liquid disappears</td>
</tr>
<tr>
<td>When a liquid evaporates, it still exists, but you can’t see it</td>
<td>Condensation is water vapor in the air that cools enough to become a liquid</td>
</tr>
<tr>
<td>Condensation on the side of a container is water that sweated through the walls of the container</td>
<td>Water is the only liquid that evaporates.</td>
</tr>
</tbody>
</table>
Group Number

Pick

Answer

1. Pick a card
2. Read the question
3. Answer
4. Paraphrase
   Praise

Fan

Respond

Fan cards for your teammate.
Part A:  **Swab the Deck**

**Get this:**  
• one alcohol prep swab packet

**Do this:**  
Tear open the packet and pull out the prep swab. Do **NOT** unfold the swab. 
Drag the swab across the table top to make a wet streak about one foot long.

**Observe:**  
1. Watch the streak for a minute or two. Describe what you see and smell. Use words and pictures. (Do NOT try to explain what happens; just describe what happens.)

**Explain:**  
2. Now **explain** what happened to the alcohol streak. Give your best guess: 
   *Where* do you think the alcohol went?  *Why* did it do this? Write your explanation in the chart. Use words and pictures.

Then you will share your ideas with your partner. Record your partner's ideas in the chart.

<table>
<thead>
<tr>
<th></th>
<th>Where did the alcohol go?</th>
<th>Why did the alcohol do this?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>My ideas:</strong></td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td><strong>My partner's ideas</strong></td>
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</table>
3. In question 2, did you and your partner agree? Now, together with your partner, think of an alternative explanation – a different way to explain where the alcohol went. Use words and pictures.

4. In questions 2 and 3 above, you came up with two ways to explain what happened. Now suppose you want to test these two ideas to see which explanation is better. Think of some simple experiments that you could do to test these two explanations.
Part B: Swab Balance

Get these:  
• thick marker pen (such as a white board marker)  
• masking tape  
• plastic ruler  
• new alcohol prep swab packet

Do this: Read these three steps first BEFORE you start doing any of them:

Step (A): Lay the marker pen on its side on the table top, and tape the pen onto the table so that it cannot roll. Lay the ruler across the pen so the ruler balances horizontally on top of the pen (the pen acts as a fulcrum).

Step (B): Now open the alcohol swab packet, pull out the prep swab – DO NOT unfold the swab – and immediately lay the wet swab on the right end of the ruler. Notice that this makes the right half of the ruler drop down, since the swab makes the right half heavier than the left half.

Step (C): QUICKLY but carefully reposition the ruler slightly on the fulcrum (the pen) so that the ruler is **perfectly balanced horizontally**: now there should be a little more of the ruler’s length on the left side of the fulcrum than on the right side, to compensate for the extra weight of the swab.

As soon as the ruler is perfectly balanced, **do not touch it**.

Observe:  
5. Watch the balance for a few minutes. What happens? Simply describe; don’t explain.

Explain:  
6. Suppose Pam says, “I think matter is made of tiny particles.” Do your observations in question 5 seem to agree with Pam? Why or why not?

Predict:  
7. The activities on this page used alcohol. If you tried all of these same activities with water instead of alcohol…
   
a) ... in what ways do you think the results would be the same as for the alcohol?

b) ...in what ways do you think the results would be different from the alcohol? Why?
Leaking Soda

Kyle and Doogie are sitting on the front porch drinking Red Bulls instead of going running.

Kyle: Whoa, dude! My Red Bull is leaking!
Doogie: No way, bro. Show me.
Kyle: Look, it’s all over the outside! This can is broken!
Doogie: So rub the can on your legs and maybe you’ll get enough energy in them to go running, dude.

Think about this story for a minute by yourself. Have you ever seen droplets on the outside of a soda can? Do you think Kyle’s can of Red Bull is leaking? How do you think the water got there?

Think silently for two minutes. Then write three of your thoughts in the chart below.

<table>
<thead>
<tr>
<th>My ideas:</th>
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<tbody>
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Now share your ideas with your partner:

- First you share one idea and your partner listens and records that idea.
- Then your partner shares an idea and you listen and record that idea.
- Take turns until you have filled in all the boxes in the chart.
Now you get to explore this concept.

1. Fill the bottle with ice. Put the top on the bottle.
2. Wipe the outside of the bottle with a paper towel so that the bottle is dry.
3. Now watch the bottle for a few minutes.

Record your observations in the table below. Use words and pictures.

<table>
<thead>
<tr>
<th>My observations:</th>
<th>My explanation:</th>
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</table>

Discuss your observations with your partner. Then write your explanation in the table. Your explanation should include:

- Evidence from your observations
- Information from the Swab the Decks and Swab Balance activities.

Finally:

Are Doogie and Kyle right? Is the Red Bull can leaking? Can you think of a test to see if the droplets on the outside of the can are coming from inside the can?
I used to think,
But now I know

Write 1 card here:

I used to think...

Now I know...
**“The Little Tent that Cried”**  
*Graphic Organizer*

<table>
<thead>
<tr>
<th>Claim 1:</th>
<th>Claim 2:</th>
<th>Claim 3:</th>
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<table>
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<tr>
<th>Evidence to support/disprove:</th>
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**Evidence using words and pictures from your experiment:**
Splash!! Right in the left eye. Rani looked up into the darkness inside the tent that was her camping home for the night. Splash!! Right smack in the right eye this time.

“Okay, who’s the wise guy?”

Splash!! Right in the middle of the forehead.

“Okay, that’s it!! Someday is in trouble and their squirt gun is toast!”

Rani turned on her flashlight only to find the tent tightly zipped up and her tent partner, Annie sleeping soundly. At least, she was pretending to sleep.

Annie, wake up!” yelled Rani as she shook her friend.

“Wha-, wha-, what’s going on?...Why are you waking me up, Rani?” said a sleepy Annie.

“You know what’s going on, Annie” said Rani angrily.

“Why is water dripping down your face, Rani? You look like you were in a shower.”

“Exactly,” spat Rani, “and I feel like I was in a shower too!”

Spat!! Right on the pillow behind her.

And now Rani felt a little sheepish. She was looking right at Annie and yet the water was still hitting her bed. She shone the flashlight up on the tent top and there it was, a drop of water waiting to fall on her bed again.

“What do I have to do, sleep under an umbrella?”

“What are you raving about, Rani? It’s the middle of the night!” And then Annie looked up at the tent top illuminated by Rani’s flashlight beam.

“Oh, no! We have a leaky tent and it must be raining. But at least it’s only on one side of the tent. Goodnight, Rani.”

“On no you don’t, Annie. We share this tent, and if I get wet, you get wet.”

“No way! I’m too tired to argue but if you want to slide over to my side, go ahead.”

Rani opened the flap on the tent and looked out. The moon and stars were bright, it was cool—but there certainly was no rain.

“There goes that theory,” said Rani and snuggled over as far as she could get toward the other side of the tent.

About an hour later: splat! Right in her right ear. This time she was too tired to care and slept the rest of the night.

The next morning, the campers awoke to another hot and muggy day. It had been in the 90s for a week now and it felt like they were swimming in hot air. Rani’s pillow was soaking wet and there was plenty of moisture on Annie’s pillow as well. Rani had to find out what was going on. It happened that everboyd had damp spots in their tents as well. All of
their tents couldn’t have been leaking and anyway there had been no rain all night. The grass was wet and the leaves on the trees were wet and the inside of all of their tents were beaded with water droplets.

Penny, their counselor, was getting the morning fire started when the girls approached her and told her the story of their wet night.

“That’s very interesting,” said Penny. “I’ll bet you are wondering where the water came from. Do you have any ideas? There has been a lot humidity lately—you know, a lot of moisture in the air. Maybe it came from there.”

Rani and Annie looked at each other. “I certainly didn’t feel any water in the air and I’ve been walking around in it for most of the week,” said Rani.

“I really think our tents are leaky,” said Annie.

“Everybody’s?” asked Penny.

“Well, that is strange, but where else could the water come from and get inside our tents if there wasn’t a hole in the tent?”

“Maybe it came from our breath. You know, like when you breathe on a window, it gets cloudy,” said Tom who was standing nearby.

“Yeah, well maybe so, but why did it collect on the tent ceiling and rain on us?” said Annie, unconvinced.

“That sounds like a lot of magic!” muttered Rani. “Invisible water from the air or our breath suddenly turning to rain inside our tents. I think it’s time for a morning swim. At least I can see that water without using my wand!!”