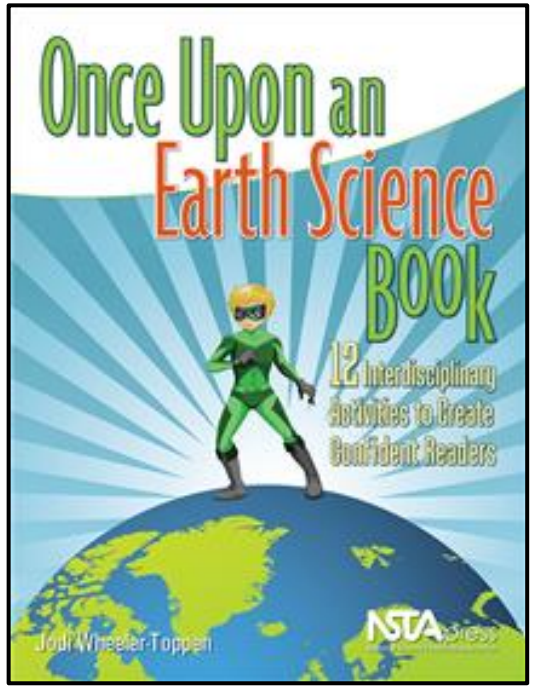
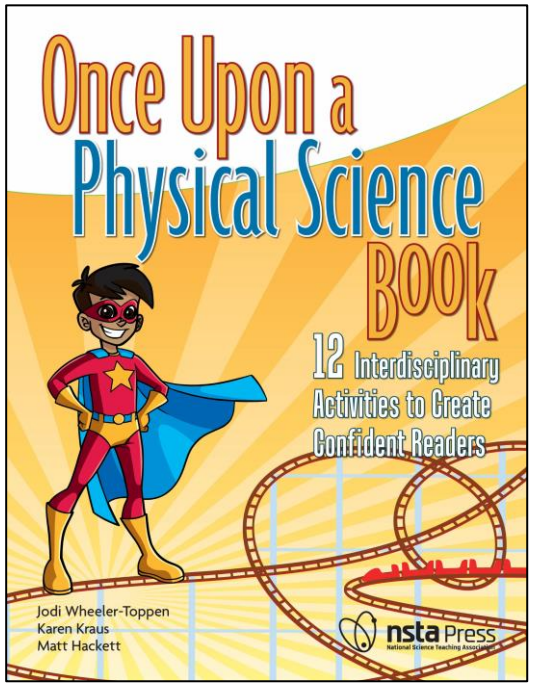
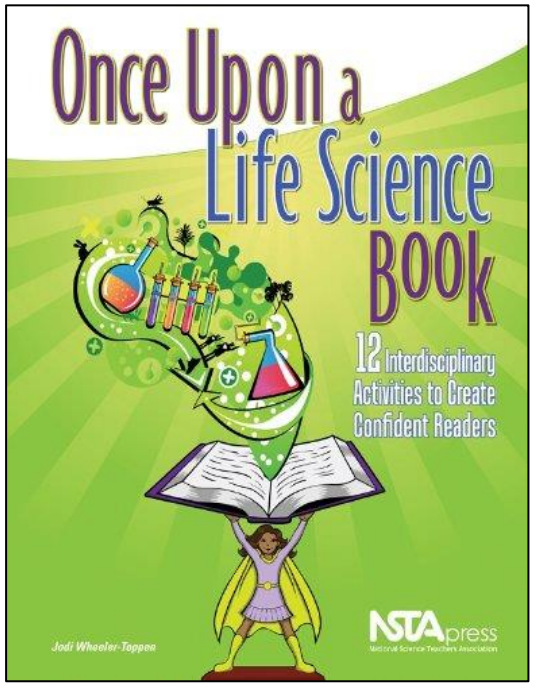
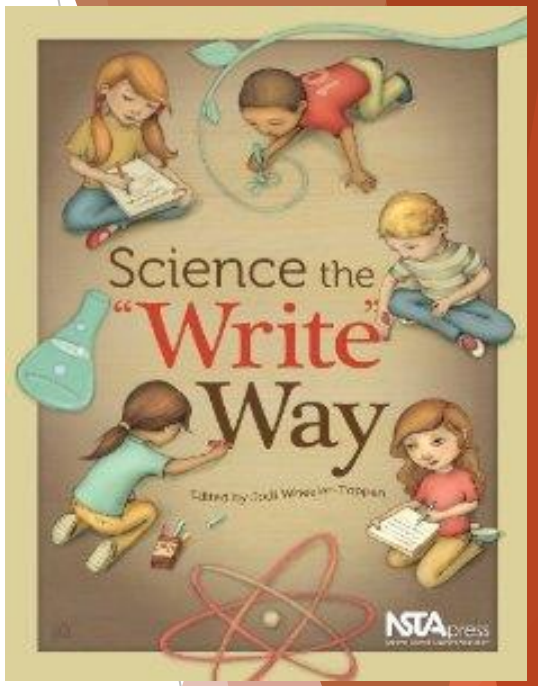
# *Science Sensemaking using Reading Groups and Language Mini-Lessons*


Jodi Wheeler-Toppen, Ph.D.



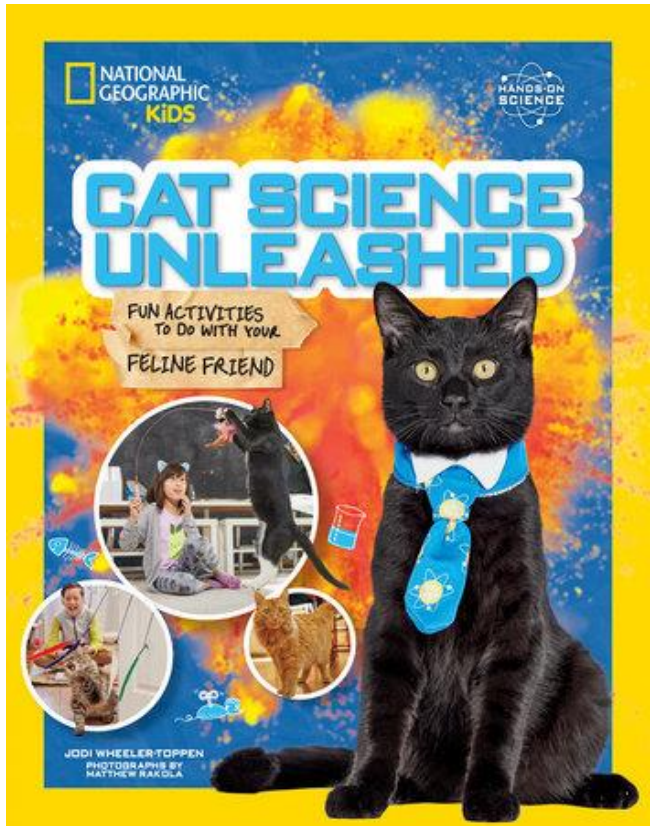



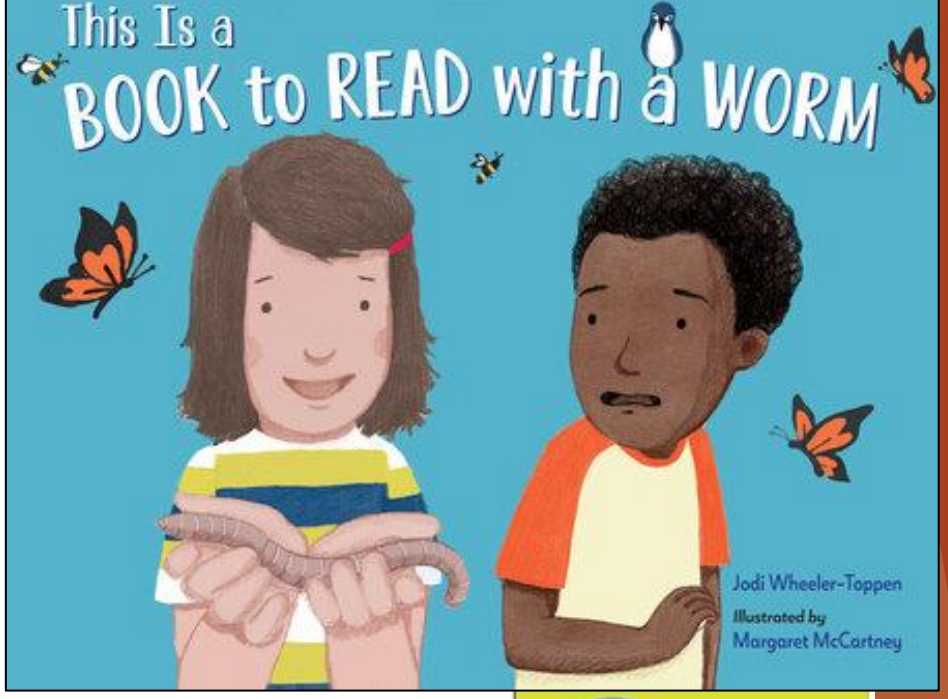



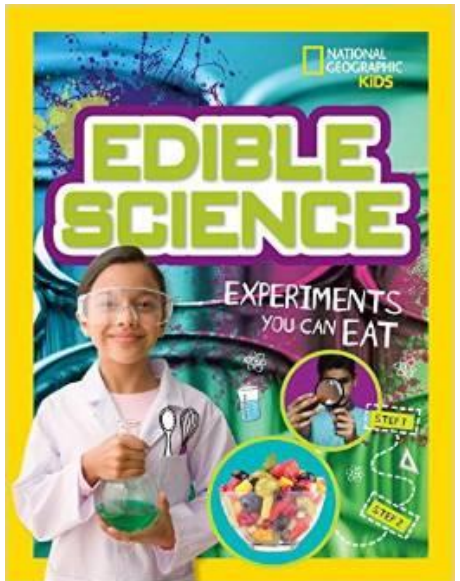



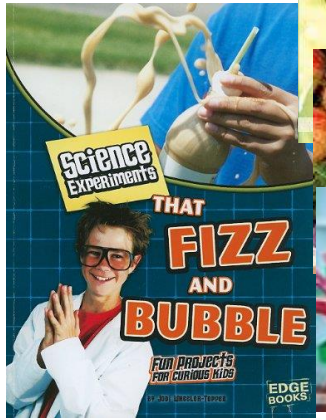

Who I am and
How I ended up here


NATIONAL GEOGRAPHIC KIDS
DOG SCIENCE UNLEASHED
FUN ACTIVITIES TO DO WITH YOUR CANINE COMPANION
JODI WHEELER-TOPPEN


NATIONAL GEOGRAPHIC KIDS
HANDS-ON SCIENCE
CAT SCIENCE UNLEASHED
FUN ACTIVITIES TO DO WITH YOUR FELINE FRIEND
JODI WHEELER-TOPPEN
PHOTOGRAPHS BY MATTHEW RAKOLA


This Is a
BOOK to READ with a WORM
Jodi Wheeler-Toppen
Illustrated by
Margaret McCartney

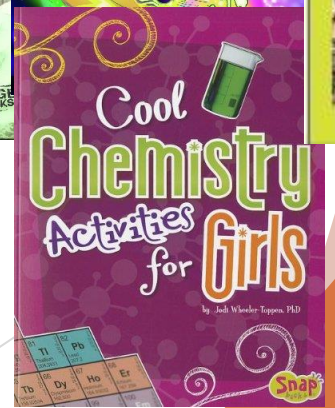

NATIONAL GEOGRAPHIC KIDS
EDIBLE SCIENCE
EXPERIMENTS YOU CAN EAT

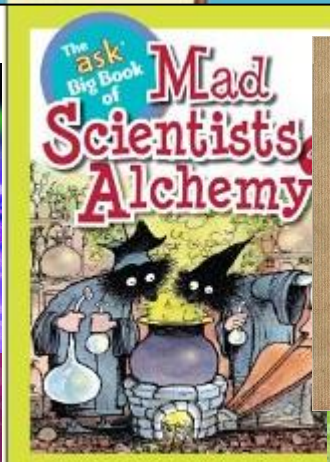

Science Experiments
THAT FIZZ AND BUBBLE
FUN PROJECTS FOR CURIOUS KIDS
EDGE BOOKS

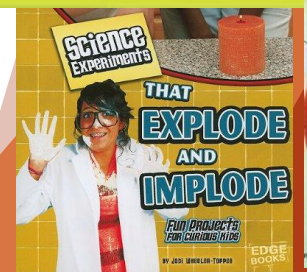

Our Ears Can Hear
Our Eyes Can See
Our Mouths Can Taste
Our Noses Can Smell
Our Skin Can Touch
Human Muscles
Fact Finders


GROSS SCIENCE PROJECTS


GHOSTS AND ATOMS


Cool Chemistry Activities for Girls
Snap


The ask Big Book of Mad Scientists Alchemy


Science Experiments
THAT EXPLODE AND IMPLODE
FUN PROJECTS FOR CURIOUS KIDS
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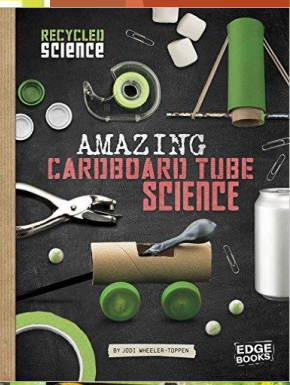
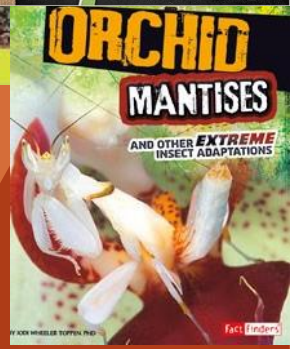

RECYCLED SCIENCE
AMAZING CARDBOARD TUBE SCIENCE
EDGE BOOKS


ORCHID MANTISES
AND OTHER EXTREME INSECT ADAPTATIONS
Fact Finders

# Your Turn

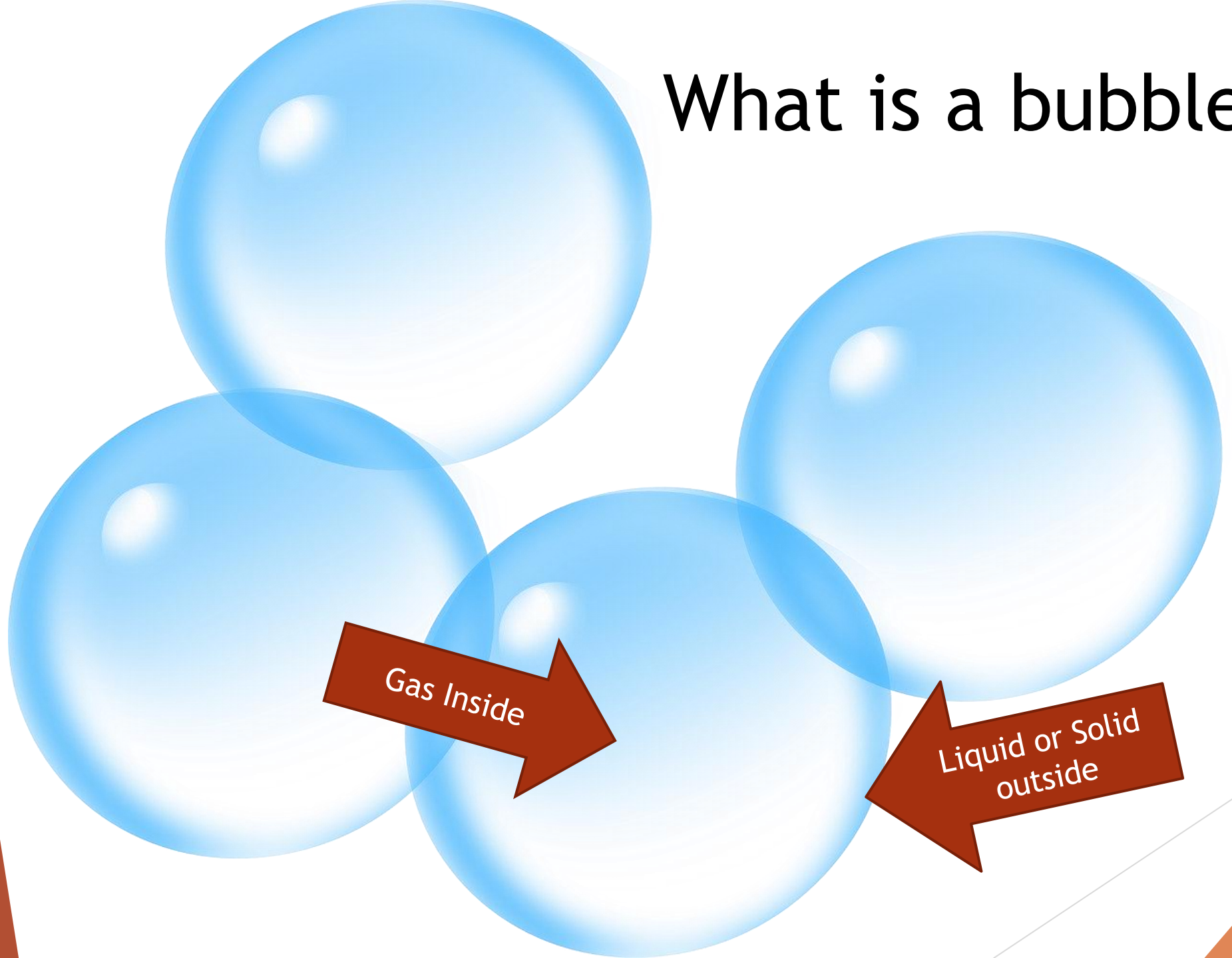
- What grades and at what schools do you teach?
- Have you been to one of my seminars before (in Henry County or at GSTA/NSTA)?
- Any particular thing you are hoping to learn?

# Agenda

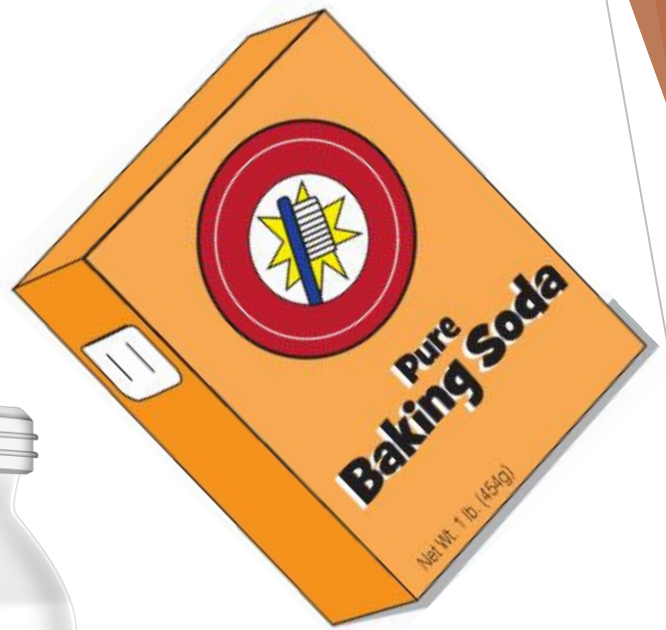
- Try a short sample lesson
- Look briefly at the lesson structure
- Introduce reading groups
- Focus on five useful reading strategies

# Sample Lesson: Chemical Change

# What is a bubble?



Two Experiments

# We made something new. What was it? Your turn to investigate.

- 1. Chew up the bubble gum. Use it to make the candle stand up in the center of the cup.
- 2. Spread baking soda around the candle.
- 3. Light the candle.
- 4. Pour vinegar into the cup or bowl until all of the baking soda is damp. Be careful not to pour it on the candle flame!

# Part 2: Reading-- French Fry Fiasco

As you read, look for clues that can help you explain what new thing you made by mixing baking soda and vinegar and why it caused the candle to go out.

Underline clues as you find them!

[Copy of reading can be found here: https://wheelertoppen.files.wordpress.com/2022/10/french-fry-fiasco.docx]

## French Fry Fiasco

"Fire!" yelled the cook.

Restaurant manager James Orvin grabbed the fire extinguisher and headed for the kitchen. He could see orange flames leaping from the deep fryer. "Hot oil," thought Orvin, "that's a grease fire." He checked his extinguisher and pulled the pin.

Fire Extinguisher

Different kinds of fire extinguishers work in different ways. Some dowse the fire in water, which lowers the temperature and stops the burning. But water and grease don't mix, and Orvin knew that a fire extinguisher filled with water might spread this fire. Other extinguishers smother the fire with a blanket of foam, but the foam can ruin cooking equipment. Like most restaurant managers, Orvin preferred carbon dioxide extinguishers. Carbon dioxide is a harmless, invisible gas. In fact, it's the same gas that makes sodas bubbly or that forms when you mix baking soda and vinegar. After a fire is put out with a carbon dioxide extinguisher, the cooking equipment can be cleaned up and put right back to work.

Orvin pointed the nozzle at the fire and released a stream of carbon dioxide. The carbon dioxide gas settled over the fire and pushed aside another gas—oxygen. Fire needs oxygen to burn. The carbon dioxide choked off the oxygen supply, and the fire sputtered out. Orvin knew the battle wasn't over quite yet. Carbon dioxide is denser, or heavier, than oxygen, so it sinks quickly to the floor. Orvin kept the extinguisher focused on the deep fryer until he was sure the fire would not reignite. Then he walked over to inspect the damage.

Deep Fryer with Oil and French Fries

"Save me those French fries," he told the cook. "I like 'em crispy."

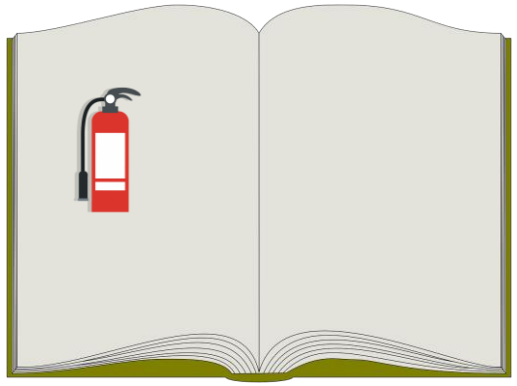
# Part 3: Writing

- Use the clues to create an explanation for why the candle went out in our ”Lights Out” activity.

- Think about organizing your explanation
  - What are your clues?
  - What order should you present them in to make a logical argument?
  - What science words will you need to include?
  - Don’t just list your clues. Fill in information so the clues make sense as an explanation.

# Lesson Structure

## Why lead with the science activity?


# More Complex Literacy Learning Cycle


science
reading
writing

# Reading Groups

# Why use reading groups?

- 1. Together, members of the group may have the background knowledge they need.
- 2. They can help each other with problem solving strategies.
- 3. It helps overcome the intelligence fallacy.

# The Intelligence Fallacy

I read and understand

=

I am smart

I read and don't understand

=

I am stupid

# Building a Classroom Conversation about Making Sense of Text

- Declare that the reading fallacy is false
- Talk about making sense of text and strategies that successful readers use
- Thinking aloud: show what good readers do
- Use reading groups to keep the conversation going

# Let’s give it a try.

(Text on Prewriting)

# Coding

*! This is important*

*✓ I knew that*

*x This is different from what I thought*

*? I don't understand*

You don't have to mark every sentence!

# Coding Example

There is no single “strongest muscle in the body,” because strength can be measured in many ways! The soleus, in the leg, exerts the most force at one time. X The heart comes in first for endurance. The masseter ? gives the most pull for its size.

# Overview of Reading Procedure

- Everyone reads (quietly) and codes section 1.
- Section 1 leader leads discussion.

- Everyone reads (quietly) and codes section 2.
- Section 2 leader leads discussion.

- Everyone reads (quietly) and codes section 3.
- Section 3 leader leads discussion.

- Answer “big question” as a group.

# A Reading Group Procedure

You are the leader for Section _____.

What to do in your group:

(a) Everyone should **read the section and code** (mark ✓, x, ?, !).

(b) The leader for this round **tells what the section was about**. If you're stuck, try starting with, "What I understand so far is…"

(c) **Ask if anyone found something confusing** (marked X or ?).

*The group should work together to figure out what the confusing words, sentence, or idea means.*

*If the group cannot make sense of it, raise your orange flag for help.*

(d) **Turn to the next leader** and **repeat for the next section**.

(e) When your group has read and discussed all three sections, work together to **answer the Big Question**.

Thoughts on the experience of working in groups?

Thoughts on the ideas in the article?

# Introducing Reading Groups

- Begin with coding. Have students code at least one text before starting reading groups. Model coding (in a think-aloud) for the class.
- When you're ready for groups:
  - Break your text into short sections (about 200-400 words).
  - Introduce the roles and procedure to the class.
  - Have a group come to the front to model the procedure for the first section of text.
  - Rest of class, in groups, does remaining sections of text.
  - On the first day, learning the procedure will be the focus (not the content).

# Reading Group Management

- Requires active, rapid management
- Provide “role notecards” for students to hold
- Make it easier to participate than not to participate
  - Where are you in the procedure? Ok, what comes next? Who needs to do that? When I come back, I expect to see…
  - Remove group members who persist in not participating. They must code and answer the question individually.
  - Likewise, watch for students who would “take over” and do the work for the group. (Model for them.)

**Alternate assignment:**

(a) Read the assigned text and code it.

(b) For each subheading (not each *section*), write a 1-2 sentence summary of what you read. If you are stuck, you can start with, "What I understand so far is…." Do this on a separate sheet of paper (NOT on the article.)

If there are no subheadings, summarize each paragraph.

(c) Answer the big question or questions.

Turn in your coded article, your summaries, and your big question(s).

# Variations on the Procedure (pick one and stick with it for awhile)

- Ask: What ideas in the section were interesting, surprising, or bothersome?
- Ask: Is there anything else from this section we should discuss?
- Ask: Can anyone add something to my summary? (or could leave out the summary and instead add the “interesting, surprising, bothersome” question after the group sorts out any difficulties)

# Interacting on Reading Strategies

Join in with groups that are going well and those that are struggling.

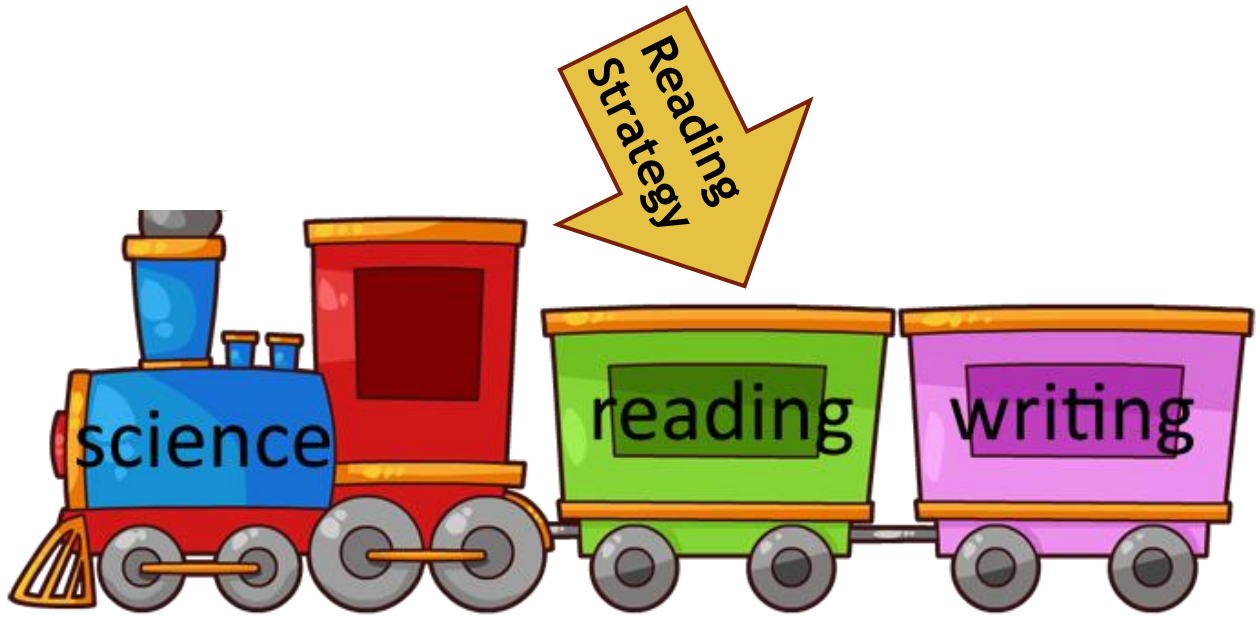
- What exactly is confusing you?
- How did you figure that out?
- What can you tell about that word? Is that enough? (Provide background knowledge if needed)
- I wonder if re-reading this section would help.

# It Gets Easier!

- It may take several tries for your students to become comfortable with the procedure and be able to focus more deeply on the content.
- You will get more comfortable (and skilled!) and interacting with the groups in a way that guides reading skills.
- Remember, this has the power to *transform* how your students interact with academic text. It's worth the energy expended to get going.

# Reading Strategies

- Having a “bank” of reading strategies can give help as you interact with reading groups.
- You can also introduce them as part of “the conversation” on reading skills



# First Skill: Identifying when you have a problem

- Noticing if you are understanding
- Pinpointing the problem
- Identifying conflicts with existing ideas

# Some Specific Aspects of Science Text

- Science text is dense.
- Science text shows the relationships between ideas.
- Science text uses a variety of forms of representation.

# Science Text is Dense

## Alternative Reading Group Procedure

- Everyone should **read the section and code** (mark ✓, x, ?, !).
- The leader for this round **tells what the section was about**. If you're stuck, try starting with, "What I understand so far is…"
- **Ask "What was surprising, thought-provoking, or confusing in this section?"**
  - *The group should listen and respond to each response.*
  - *If the group wants teacher input, raise your orange flag.*
- **Turn to the next leader** and **repeat for the next section**.
- When your group has read and discussed all three sections, work together to **answer the Big Question**.

# What thoughts or questions would you like to share back with the class?

More on Text Density

# Science Text Shows the Relationships Between Ideas

# “Penguins, however, are built for swimming and diving.”

- What kind of information probably came before this sentence? After it?
- What clues did you use to make your guesses?

Most birds are built for flying, with lightweight, hollow wing bones.

Penguins, however, are built for swimming and diving.

They have heavy bones that make their wings work like flippers.

# Words that help us see relationships are called “signal words.”

| Contrast Signal Words |
| --- |
| However |
| In contrast |
| On the other hand |
| Conversely |
| Whereas |
| But, yet, while* |

* Sometimes indicate a contrast

| Comparison Signal Words |
| --- |
| In the same way |
| Just like |
| Just as |
| Likewise |
| Also |
| Similarly |

When we see compare/contrast signal words, we should look for:

What is being compared/contrasted?

How are they similar/different?

# When we see contrast signal words

Most birds are built for flying, with lightweight, hollow wing bones. Penguins, however, are built for swimming and diving. They have heavy bones that make their wings work like flippers.

- What two things are being contrasted?
- What makes them different?

# Signal Words for Examples and Lists

- This may seem obvious, but the point is, when you see these words, you should be asking yourself:
  - How do these illustrate the point being made?
  - Do I understand why this is an example of the idea?

| Examples |
| --- |
| For example, |
| Like |
| Such as |
| To illustrate |
| For instance |
| e.g. (stands for the Latin *exempli gratis* and means for example) |

# Signals for Lists

- Again, obvious, right? But it should pose a question in your mind: what are the four main differences? Or what are the senses? Then you should be reading to answer that question.

| Signal | Example |
| --- | --- |
| Statement with a number | There are 4 main differences between monocots and dicots. |
| A statement followed by a colon | Use all of your senses: taste, touch, hearing, smell, and sight. |

| Cause and Effect Signal Words |
| --- |
| Cause/ are caused by |
| Consequently |
| As a result |
| Therefore |
| For this reason |
| Thus |
| Hence |
| In response to |
| Since |

| Cause |  | Effect |
| --- | --- | --- |

# Science text uses a variety of forms of representation.

## Alternative Reading Group Procedure

- Everyone should **read the section and code** (mark ✓, x, ?, !).
- The leader for this round **tells what the section was about**. If you're stuck, try starting with, "What I understand so far is…"
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# What thoughts or questions would you like to share back with the class?

# Contact Me:

OnceUponAScienceBook.com

wheelertop@gmail.com

**Thank you for your participation!**

Session Evaluation

# Text Density and long nouns

**The water is hot.**

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A well-insulated thermos with both trapped air and a vacuum is effective at stopping heat transfer.

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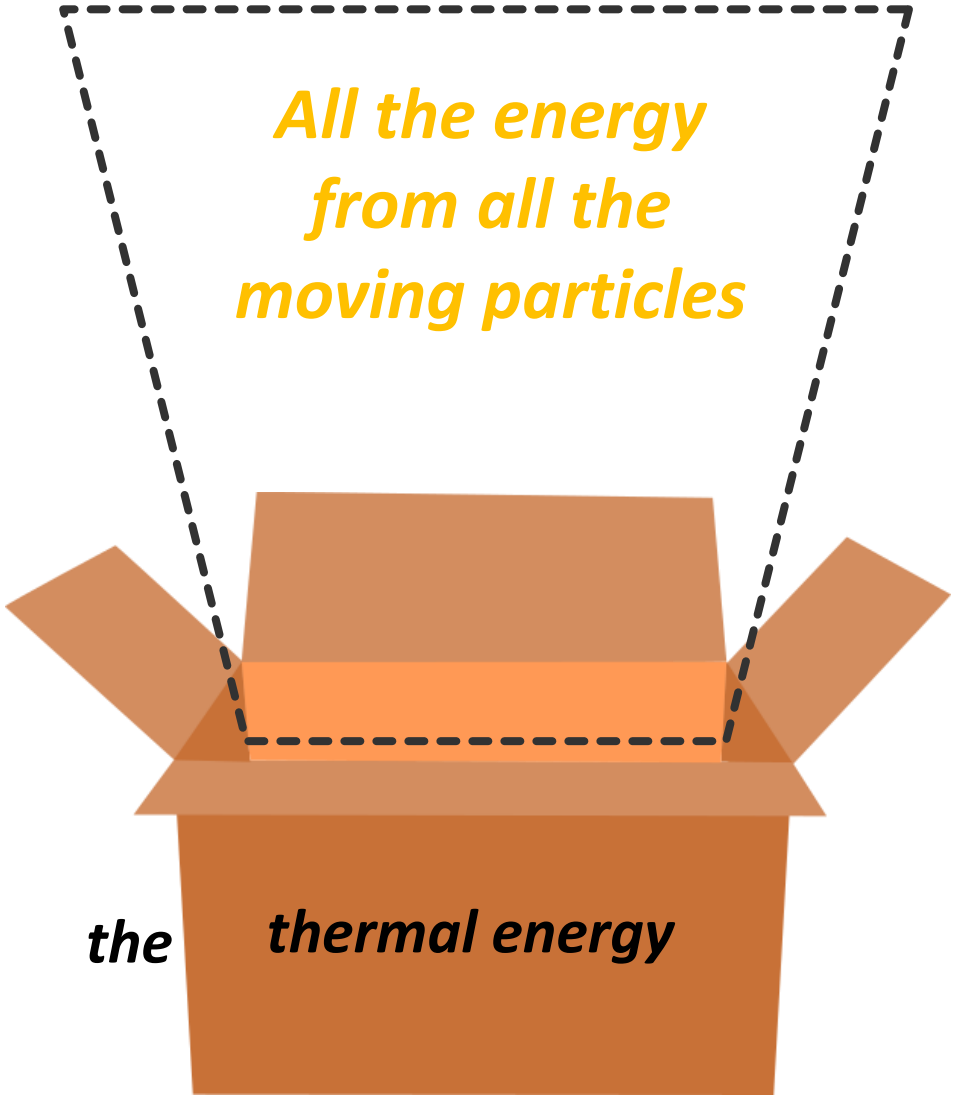
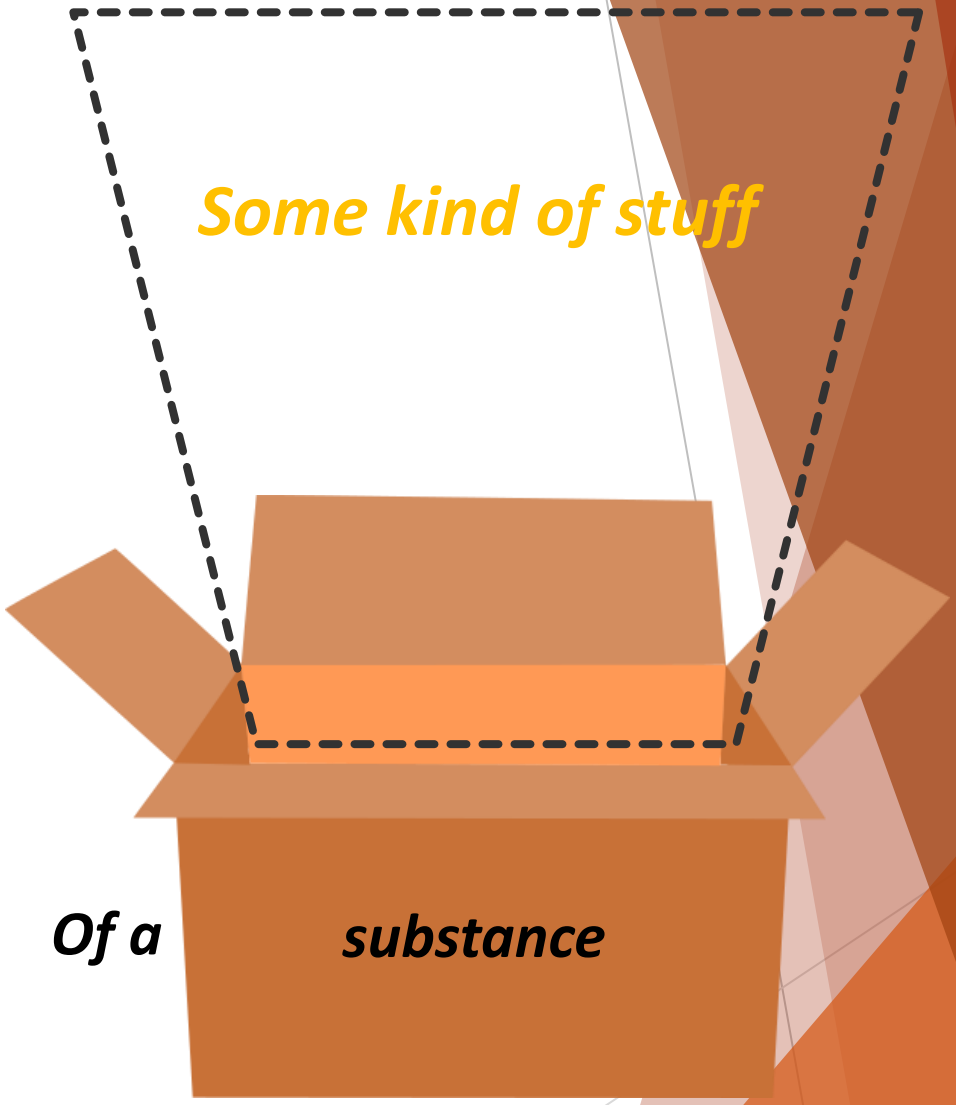
# Text Density and long nouns

As *the thermal* ***energy*** *of a substance* increases, its particles spread out and the substance expands. *The* ***expanding*** *of matter when it is heated* is known as thermal expansion.

(From Prentice Hall Science Explorer: Physical Science, 2002. Page 453)

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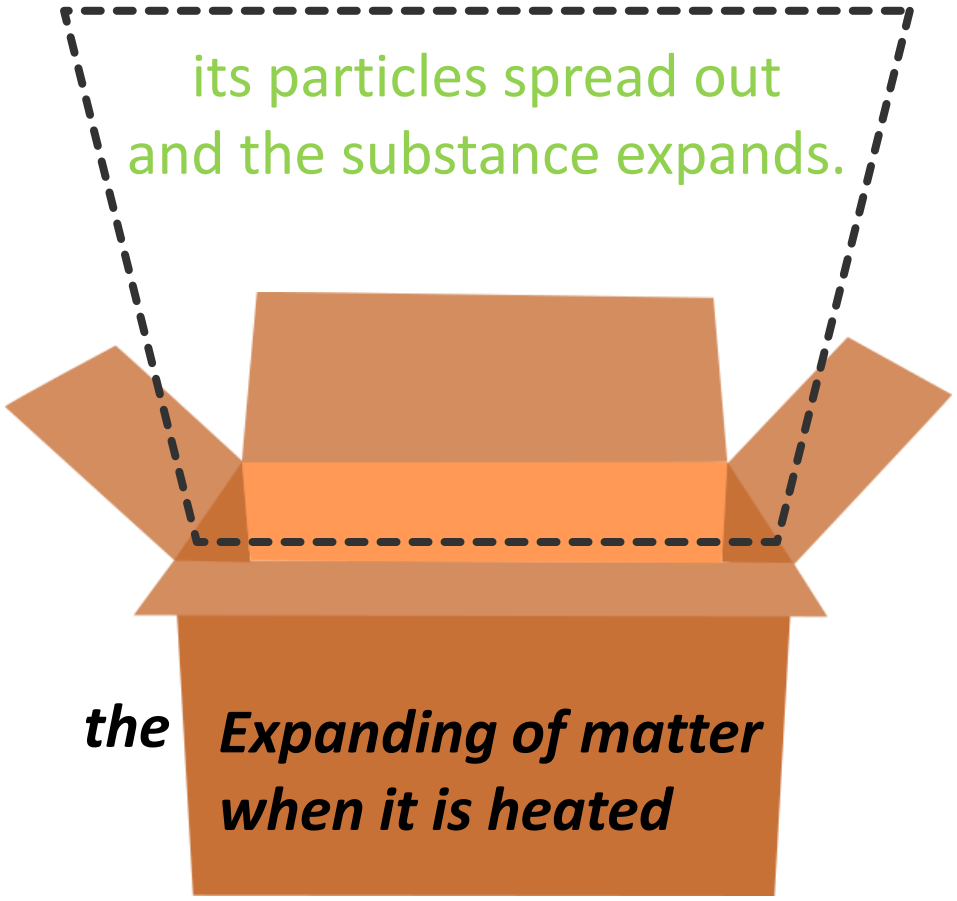


***The expanding of matter when it is heated*** is known as thermal expansion.

Matter is made up of tiny particles called atoms and molecules. (p436)

**The particles that make up a solid** are packed together in relatively fixed positions. (p450)

As the thermal energy of a solid increases, **the rigid structure of its particles** begins to break down. (p.451)