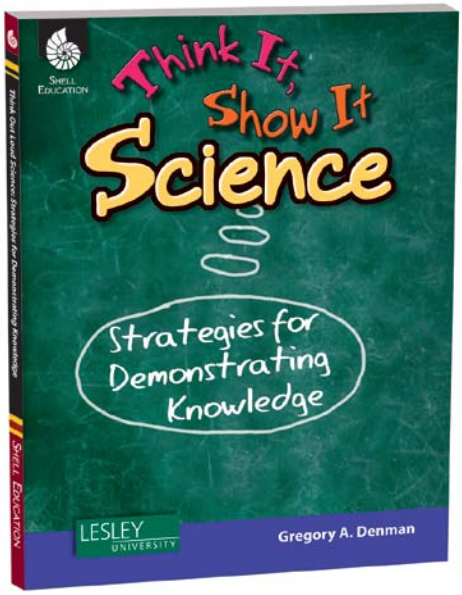
# Think It, Show It Science…Strategies for Demonstrating Knowledge




**Gregory Denman**
**gregcolo@comcast.net**

# Introduction

Many schools presently face a curricular dilemma not unlike that of a friend of mine in a school in Colorado. At her school, the decision had been made to focus primarily on reading and writing during the first half of the year in advance of the state's yearly assessments. Since her class of third graders, many of whom were below benchmark, would not be tested in science that academic year, it was rationalized that for the sake of the school's literacy scores, the students would best be served by postponing any science instruction until after the tests were administered. Unfortunately, the test results that year indicated that a portion of her students were still falling below benchmark. The question was then raised: Now what should be done? Should they do away with science completely for the remainder of the year in order to put another reading intervention period into the schedule in an effort to get the kids to benchmark?

This predicament, or a version thereof, is not unique to my friend's school. In many elementary schools (both with higher- and lower-functioning students), the importance of science as an integral and vital part of all students' educational landscape is being contested—contested not for pedagogical reasons but solely and understandably as a reaction to the pressure of state and federal mandated tests and their highly competitive publicized scores. As a result, science, like art, music, and to a large measure, physical education, is systematically being sidelined in the curriculum and in some cases completely eliminated in order to devote as much time as possible to a multitude of reading and writing interventions—this in an age when, as expressed in Appendix A of the *Next Generation Science Standards*, "Given the importance of science and engineering in the 21st century, students require a sense of contextual understanding with regard to scientific knowledge, how it is acquired and applied, and how science is connected through a series of concepts that help further our understanding of the world around us" (2013, 1).

Reading and writing are, of course, absolutely critical skills. For all practical purposes in today's global, informational, and technologically driven world, literacy is nothing less than an economic life skill, and as such, students' progress with it should be monitored regularly. All students need to be able to read with discerning comprehension and use written communication with precision and clarity. What is missing from the science versus exclusive literacy instruction argument, in the view of many educators, is that science, in and of itself, presents students with incredibly engaging content in which both reading and writing instruction can be integrated not only to support science instruction but also to augment the acquisition of 21st century literacy skills.

Indeed the *Common Core State Standards* emphasizes that "Literacy standards…are predicated on teachers of ELA, history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields" (2010, 3).

In fact, the *Common Core State Standards* specifically addresses these literacy skills with their *Reading Standards for Informational Text*:

- Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- Determine the main ideas of a text; recount the key details and explain how they support the main idea.
- Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause and effect.
- Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (2010, 14).

In the same way, writing can be infused into the science classroom. After a lesson in which mill worms are observed by third graders, a follow-up writing lesson might be an observation-notes paragraph. Included in a life science unit can be written pieces in which students compare and contrast plant and animal cells. A scientific conclusion provides a perfect way to bring closure to an experiment in a fifth-grade science class that involves and records all the steps of the scientific method and does so with a strong literacy link. Structured and authentic reading and writing tasks such as these are decisive in helping students make sense of and remember what they are learning in science. Within the context of an inquiry-based, activity-geared science classroom, reading and writing tasks function as co-conspirators in the acquisition of both science principles and concepts and the skills and processes of literacy. This curricular merger is clearly delineated in the *Next Generation Science Standards:*

> "Engagement in any of the scientific and engineering practices involves both scientific sense-making and language use. Students engage in these practices for the scientific sense-making process, as they transition from their inexperienced conceptions of the world to more scientifically-based conceptions. Engagement in these practices is also language intensive and requires students to participate in classroom science discourse. Students must read, write, and visually represent as they develop their models and explanations. They speak and listen as they present their ideas or engage in reasoned argumentation with others to refine their ideas and reach shared conclusions" (2013, 2).

*Think It, Show It Science: Strategies for Demonstrating Knowledge* has a single purpose: to give teachers a series of practical and clear-cut materials and strategies on how to integrate discipline-specific writing instruction and student discussion into their science curriculum. In the book, I have steered clear of any lengthy discussions about methods of science instruction. Although they will be referred to, you won't, for example, find an examination of inquiry-based instruction or the scientific method. As a science teacher, you likely already know this material. If you do not, there are many fine texts available

on the topic. What you will find are research-based strategies as they are used by real (in-the-day-to-day-educational-trenches) teachers in real (way-too-much-curriculum-to-cover) classroom strategies that can be used as a blueprint for instruction. This collection of research-based strategies has been researched and developed into a book that I myself would have liked to have had available during my teaching years, particularly during my first few years in the classroom.

I, like many newly sanctioned elementary teachers of my era, started my classroom teaching with an adequate background in literacy (predominantly children's literature and reading instruction) but only a minimum of science instruction—and virtually nothing on specific writing and literacy strategies to use in the discipline of science. The students and I muddled through those first few years and did the best we could. We conducted experiments, observed classroom plants growing, and took an enlarged look at their structures under our classroom microscopes. We even wrote a science poem or two. However, we never even approached the distinct field of scientific writing—the analytical/expository writing that would allow my students to accurately demonstrate, discuss, and help solidify their thinking and learning in science. It was a sadly missed opportunity for my students, I'm afraid. As I have researched, worked with teachers, and put together this book, I have often felt an urgent desire to write to the students I taught during those first years a sincere note of apology for my less-than-inspired science instruction.

A more recent trend, as a result of state assessment scores continuing to indicate that many of our students are struggling with writing skills, is termed "writing across the curriculum." Indeed *Common Core State Standards* insists that that instruction in reading, writing, speaking, listening, and language be a shared responsibility within the school (2010). Science teachers, as well as other content-area teachers are being required by their districts to incorporate more writing into their classes. Today, as a writing consultant who visits schools in many states, I am often asked to assist these content-area teachers in this effort. For some teachers, integrating more writing has been a relatively simple task. Many times it is something that they already have been doing regularly. But others understandably feel challenged, if not to some extent threatened. "I'm a science teacher," they say, "Science is what I was trained in, not English and grammar." My hope is that this book will help teachers, regardless of the amount of background they have with writing instruction, to more comfortably and effectively infuse writing into their science classrooms. I hope that I can demonstrate how writing can become not just another requirement but an essential learning and processing component in their classrooms.

Equally importantly, I hope this book will aid science teachers and their schools by providing a sound argument for not limiting or eliminating science in favor of more and more literacy instruction in their classrooms. Returning to my friend in Colorado whose school needed to decide what direction to take after the low literacy scores, the options were to drop science for an additional reading intervention period or to continue with the science curriculum that they had postponed until after the testing. As it turned out, my friend was given the go-ahead and allowed to teach her science curriculum. But she was clearly cautioned that she must be able to prove that her science classes did include and

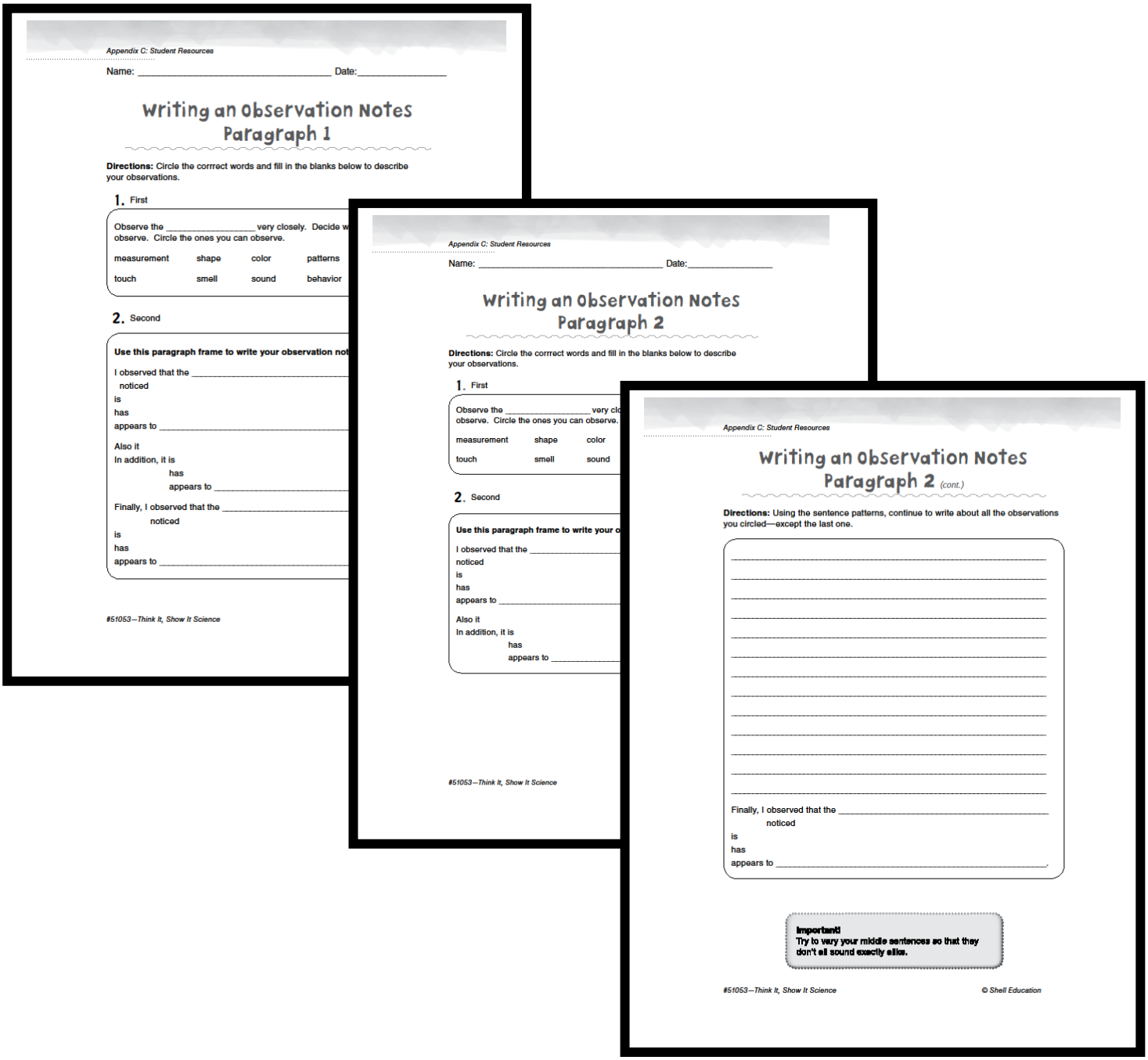
 

support essential literacy skills. Accountability, as you know, cuts a deep and challenging ravine that must be crossed regularly with today's curriculum decisions.

At the end of the year, my friend invited her school's literacy coach and principals to her classroom. In it were bulletin boards and student journals displaying a multitude of her students' writing endeavors: observations, comparisons, experiment notes, and science poems, many with colorful illustrations and finalized in clear, coherent paragraphs. These, she pointed out, directly aligned with the objectives and standards as established by the district regarding writing for different purposes and audiences. She discussed how she had taught reading strategies with many of the books and articles that accompanied the units and how excited her students were with learning and recording all of their new science-vocabulary words (*habitat*, *vertebrae*, *environment*, etc.) in their science journals. She related how her class had read more books from the library during this period than they had all year. They had run the librarian ragged trying to locate books on amphibians, food chains, and the like.

What was most convincing, however, was her account of how enthused the students had been with the science activities—they could not wait for the frog and crab habitats to be established in their classroom and, as you would guess, how they were counting the days until middle school when they would get to dissect a frog! She talked about how engaged students were with their data collection routines and experiments, along with their follow-up writing tasks and how each of the topics of her science units had excited her entire class. This teacher's experience, which I know is not in any way unique to her classroom, illustrates that the natural synergy of linking science and literacy instruction strengthens students' skills in both areas. And it does so in a way that invigorates both the instruction and the students. It demonstrates a simple but undeniably accurate concept that I express as this: *Engaged learners learn*!

—Greg



*Appendix C: Student Resources*

Name: _____ Date: _____

## Writing an Observation Notes Paragraph 1

**Directions:** Circle the corrrect words and fill in the blanks below to describe your observations.

**1.** First

Observe the _____ very closely. Decide w
observe. Circle the ones you can observe.

measurement shape color patterns

touch smell sound behavior

**2.** Second

**Use this paragraph frame to write your observation not**

I observed that the _____
noticed
is
has
appears to _____

Also it
In addition, it is
has
appears to _____

Finally, I observed that the _____
noticed
is
has
appears to _____

*#51053—Think It, Show It Science*

*Appendix C: Student Resources*

Name: _____ Date: _____

## Writing an Observation Notes Paragraph 2

**Directions:** Circle the corrrect words and fill in the blanks below to describe your observations.

**1.** First

Observe the _____ very clo
observe. Circle the ones you can observe.

measurement shape color

touch smell sound

**2.** Second

**Use this paragraph frame to write your o**

I observed that the _____
noticed
is
has
appears to _____

Also it
In addition, it is
has
appears to _____

*#51053—Think It, Show It Science*

*Appendix C: Student Resources*

## Writing an Observation Notes Paragraph 2 *(cont.)*

**Directions:** Using the sentence patterns, continue to write about all the observations you circled—except the last one.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Finally, I observed that the _____
noticed
is
has
appears to _____.

**Important!**
**Try to vary your middle sentences so that they don't all sound exactly alike.**

*#51053—Think It, Show It Science* *© Shell Education*

# NOTES

Name: _____ Date:_____

# Writing an Observation Notes Paragraph 1

**Directions:** Circle the corrrect words and fill in the blanks below to describe your observations.

## 1. First

Observe the _____ very closely. Decide which of these you can observe. Circle the ones you can observe.

| | | | | |
|---|---|---|---|---|
| measurement | shape | color | patterns | texture |
| touch | smell | sound | behavior | movement |

## 2. Second

**Use this paragraph frame to write your observation notes.**

I observed that the _____
noticed
is
has
appears to _____.

Also it
In addition, it is
has
appears to _____.

Finally, I observed that the _____
noticed
is
has
appears to _____.

Name: _____ Date:_____

# Writing an Observation Notes Paragraph 2

**Directions:** Circle the corrrect words and fill in the blanks below to describe your observations.

## 1. First

Observe the _____ very closely. Decide which of these you can observe. Circle the ones you can observe.

| | | | | |
|---|---|---|---|---|
| measurement | shape | color | patterns | texture |
| touch | smell | sound | behavior | movement |

## 2. Second

**Use this paragraph frame to write your observation notes.**

I observed that the _____
noticed
is
has
appears to _____.

Also it
In addition, it is
has
appears to _____.

# Writing an Observation Notes Paragraph 2 *(cont.)*

**Directions:** Using the sentence patterns, continue to write about all the observations you circled—except the last one.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Finally, I observed that the _____
noticed
is
has
appears to _____.

**Important!**
Try to vary your middle sentences so that they don't all sound exactly alike.

Name: _____ Date: _____

# Writing an Observation Notes Paragraph That Records Change

**Directions:** Fill in the blanks and circle the words you chose from the options provided to complete the activity sheet.

Subject _____

I observed that the _____

noticed

is

has

appears to _____

_____.

When

After

Yet when

However _____

it is

has

appears to _____

_____.





## NOTES

Name: _____ Date:_____

# Writing an Observation Notes Paragraph That Records Change

**Directions:** Fill in the blanks and circle the words you chose from the options provided to complete the activity sheet.

Subject _____

I observed that the _____

noticed

is

has

appears to _____

_____.

When

After

Yet when

However _____

it is

has

appears to _____

_____.

Name: _____ Date: _____

# Writing Data Analysis Statements

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

The bar graph
data table shows
line graph tells me
circle graph demonstrates that

_____

_____.

(Data Interpretation: What I know)

I know because _____

_____.

But
While
Whereas
In contrast to_____

_____.

(Evidence Statement: How I know it)

Additional evidence statements can begin with transition words such as also or another way.





## NOTES

Name: _____ Date:_____

# Writing Data Analysis Statements

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

The bar graph

data table shows

line graph tells me

circle graph demonstrates that

_____

_____.

(Data Interpretation: What I know)

I know because _____

_____.

But

While

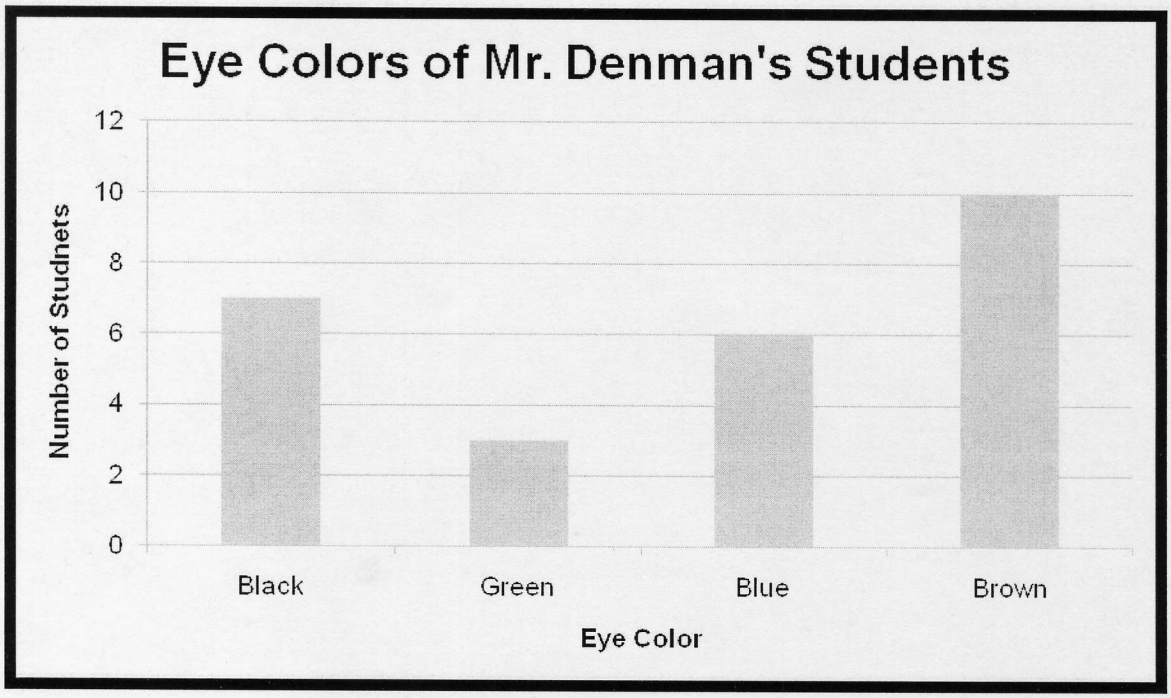
Whereas

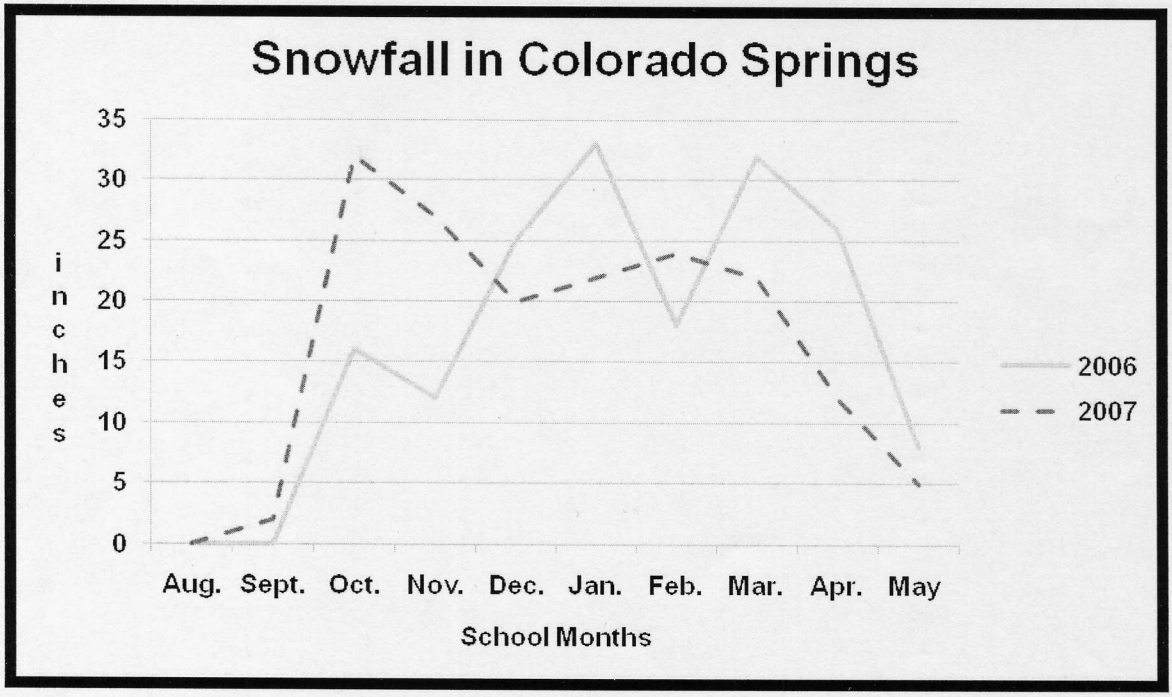
In contrast to_____

_____.

(Evidence Statement: How I know it)

Additional evidence statements can begin with transition words such as also or another way.


Eye Colors of Mr. Denman's Students
Number of Studnets
12
10
8
6
4
2
0
Black
Green
Blue
Brown
Eye Color


Snowfall in Colorado Springs
inches
35
30
25
20
15
10
5
0
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
School Months
2006
2007

Name: _____ Date:_____

# Comparisons and Contrasts

**Directions:** Fill in the blanks below to describe the similarities and differences between your two chosen objects or concepts.

**Topic:**

**Subjects:** and

**Comparisons:** (Similarities)

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

**Contrasts:** (Differences)

1. _____

_____

2. _____

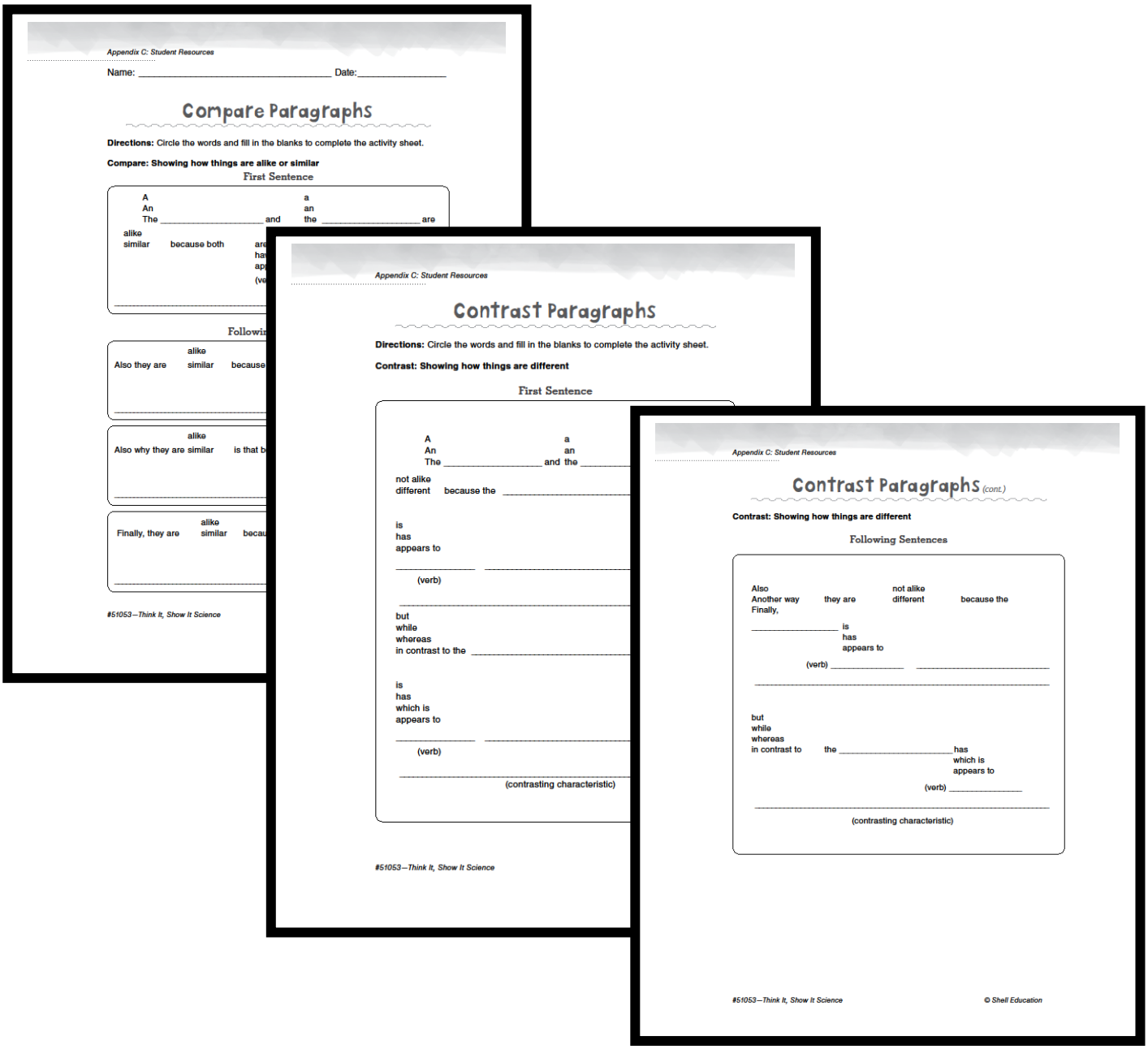
_____

3. _____

_____

4. _____

_____



Appendix C: Student Resources

Name: _____ Date: _____

## Compare Paragraphs

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

**Compare: Showing how things are alike or similar**

First Sentence

A / An / The _____ and a / an / the _____ are

alike / similar because both

_____

Following

Also they are alike / similar because

_____

Also why they are similar alike is that b

_____

Finally, they are alike / similar becau

_____

#51053—Think It, Show It Science

Appendix C: Student Resources

## Contrast Paragraphs

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

**Contrast: Showing how things are different**

First Sentence

A / An / The _____ and a / an / the _____

not alike / different because the _____

is / has / appears to

_____ _____

(verb)

_____

but / while / whereas / in contrast to the _____

is / has / which is / appears to

_____ _____

(verb)

_____

(contrasting characteristic)

#51053—Think It, Show It Science

Appendix C: Student Resources

## Contrast Paragraphs *(cont.)*

**Contrast: Showing how things are different**

Following Sentences

Also / Another way / Finally, they are not alike / different because the

_____ is / has / appears to

(verb) _____ _____

_____

but / while / whereas / in contrast to the _____ has / which is / appears to

(verb) _____

_____

(contrasting characteristic)

#51053—Think It, Show It Science © Shell Education

# NOTES

Name: _____ Date:_____

# Compare Paragraphs

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

**Compare: Showing how things are alike or similar**

## First Sentence

A / An / The _____ and a / an / the _____ are

alike / similar because both are / have / appear to _____ (verb) _____

_____

## Following Sentences

Also they are alike / similar because both are / have / appear to _____ (verb) _____

_____

Also why they are alike / similar is that both are / have / appear to _____ (verb) _____

_____

Finally, they are alike / similar because both are / have / appear to _____ (verb) _____

_____

# Contrast Paragraphs

**Directions:** Circle the words and fill in the blanks to complete the activity sheet.

**Contrast: Showing how things are different**

## First Sentence

A / An / The _____ and a / an / the _____ are

not alike / different because the _____

is / has / appears to

_____ _____

(verb)

_____

but / while / whereas / in contrast to the _____

is / has / which is / appears to

_____ _____

(verb)

_____ .

(contrasting characteristic)

# Contrast Paragraphs *(cont.)*

**Contrast: Showing how things are different**

## Following Sentences

Also
Another way they are not alike
Finally, different because the

_____ is
has
appears to

(verb) _____ _____

_____

but
while
whereas
in contrast to the _____ has
which is
appears to

(verb) _____

_____

(contrasting characteristic)

Name: _____ Date:_____

# Writing "Why" Explanations

**Directions:** Complete the graphic organizer below to explain why your chosen scientific process occurs.

## Scientific Process

_____

## Topic Sentence

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

**Sequence Words:**
(order words)

- first
- second
- then
- after that
- next
- finally

**Cause-and-Effect Words:**
(something happening as a result of something else)

- because
- a reason for this
- so
- when
- as a result
- since
- consequently
- if
- due to

Name: _____ Date: _____

# Writing "Why" Explanations

**Directions:** Complete the graphic organizer below to explain why your chosen scientific process occurs.

**Scientific Process**

_____

**Topic Sentence**

_____

_____

_____

_____

_____

_____

_____

_____

_____

**Sequence Words:**
(order words)

- first
- second
- then
- after that
- next
- finally

**Cause-and-Effect Words:**
(something happening as a result of something else)

- because
- a reason for this
- so
- when
- as a result
- since
- consequently
- if
- due to





## NOTES

# MENTOR TEXTS

## Missing the School Bus

**Missing your school bus in the morning is definitely not a good idea. The reason why is a simple one. If you miss the bus you will have to walk back to your house and tell your mother. Since she is busy trying to get herself ready for work, chances are she is going to be upset with you because now she has to drive you to school. As a result of having to drive you to school, she is probably going to be late for her job and consequently you are in for a long lecture. Finally, when you do arrive at school you are in such a bad mood because of the lecture you received from your mother that you probably wouldn't be any fun to be around for most of the morning.**

- Underline the topic sentence(s)
- Circle any sequence words
- Box the cause-and-effect words

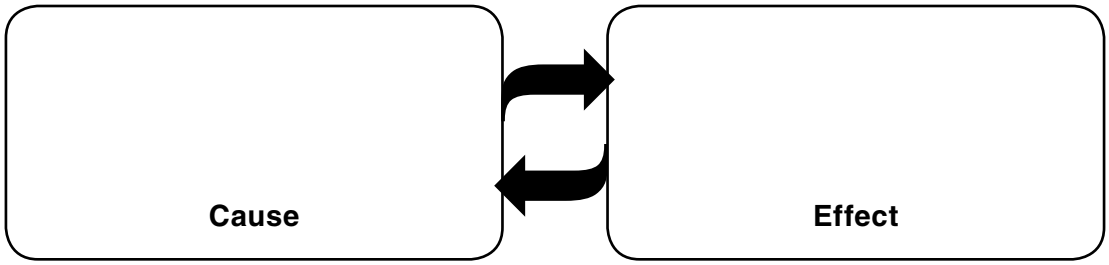
## Scientific Process: Digestion

**How food is digested in our bodies is easy to understand if you see it as a step-by-step process. Digestion begins in your mouth as a result of your first bite into your food. Your teeth first grind what you have eaten into smaller pieces and then your saliva begins to break it into smaller molecules. Next, when you swallow the food it goes down your esophagus into your stomach. In your stomach the food continues to be broken down as it mixes with digestive juices. After that the food leaves the stomach it enters the small intestine. Here the food finally is small enough to pass into your blood stream and give you nourishment.**

Name: _____ Date:_____

# Cause-and-Effect Sentences 1

**Directions:** Write a cause and an effect. Then, write sentences to describe how the cause and effect are related.




**1.** _____

_____

_____

_____

(cause first sentence)

Put a box around your cause-and-effect word(s).

**2.** _____

_____

_____

_____

(effect first sentence)

Put a box around your cause-and-effect word(s).

**Cause-and-Effect Words:**

(something happening as a result of something else)

- because
- a reason for this
- so
- when
- as a result
- since
- consequently
- if
- due to