The Making of a Scientist Unit Resources

Student Resource	Location
Section 1: Lessons 1-5	
Text: *The Templeton Twins Have an Idea* by Ellis Weiner	Purchased text
Text: "The Making of a Scientist" by Richard Feynman	The Making of a Scientist Unit Reader
Lesson handouts	Pages 2 – 9
Section 2: Lessons 6-11	
Text: *The Templeton Twins Have an Idea* by Ellis Weiner	Purchased text
Text: Scientific Thinking	Page 11 – 12
Text: "The Making of a Scientist" by Richard Feynman	The Making of a Scientist Unit Reader
Text: Modern Science: What's Changing?	The Making of a Scientist Unit Reader
Lesson handouts	Pages 10 – 19
Section 3: Lessons 12-19	
Text: "The Making of a Scientist" by Richard Feynman	The Making of a Scientist Unit Reader
Text: 13 Planets: The Latest View of the Solar System by David Aguilar	Purchased text
Text: Video of Is Pluto a Planet?	Digital access
Lesson handouts	Pages 20 – 27
Section 4: Lessons 20-23	
Text: "Galileo Galilei: Biography, Inventions and Other Facts," by Nola Taylor Redd	The Making of a Scientist Unit Reader
Text: The Templeton Twins Have an Idea, by Ellis Weiner	Purchased text
Text: Video: "The Mystery of the Milky Way"	Purchased text or digital access
Lesson handouts	Pages 28 – 30
Section 5: Lessons 24-26	
Text: "New Theory: Galileo Discovered Neptune" by Robert Roy Britt	The Making of a Scientist Unit Reader
Text: "The Making of a Scientist" by Richard Feynman	Purchased text
Text: "Galileo Galilei: Biography, Inventions & Other Facts," by Nola Taylor Redd	The Making of a Scientist Unit Reader
Lesson handouts	Pages 31 – 33
Section 6: Lessons 27-29 (Cold-Read Task)	
Section 7: Lessons 30-33 (Culminating Writing Task)	
Text: "The Making of a Scientist" by Richard Feynman	Purchased text
Text: Scientific Thinking	Pages 11 – 12
Lesson handouts	Pages 34 – 35
Section 8: Lessons 34-35	
Text: Giants of Science: Isaac Newton, by Kathleen Krull	The Making of a Scientist Unit Reader
Lesson handouts	Pages 36 – 38
Section 9: Lessons 36-40 (Extension Task)	
Text: "The Making of a Scientist" by Richard Feynman	Purchased text
Text: The Templeton Twins Have an Idea by Ellis Weiner	Purchased text
Lesson handouts	Page 39

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Observation/Inference Handout

Bag Number	My Observations	My Inference	Fact (What's actually in the bag?)

Conversation Stems[1]

Clarifying

- To be clear, you're saying that…
- I'm confused when you say X. Can you elaborate?

Paraphrasing

- Put another way, you're saying…
- I hear you saying that…

Agreeing

- I agree with ___ because…
- ___'s point about ___ was important because…
- The reasons you provided support what I am saying because...
- You and I are coming from the same position.

Disagreeing

- I see it differently because…
- I agree that ___, but we also have to consider that…
- We see ___ differently.

Elaborating

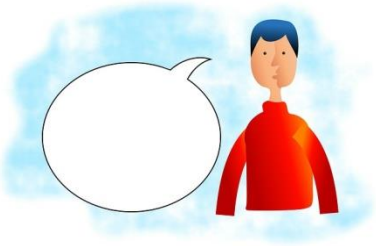
- ___ mentioned that…
- Adding to what you said,…
- I agree, and I want to add that...

Summarizing

- Overall, what I'm trying to say is…
- My whole point in one sentence is…
- More than anything else, I believe that…

[1] Adapted from te@chthought at http://www.teachthought.com/learning/sentence-stems-higher-level-conversation-classroom/

Book Club Handout

Role	Job
Word Wizard 	• Find unfamiliar words in this section of the text • Record the word and context in your reading log • Make an inference about the meaning of the word in your reading log • Lead your book club's vocabulary discussion
Character Captain 	• Note all the characters who appear in this section of the text • Record important details about them in your reading log • Write a one-sentence inference about that character, based on the details you found • Lead your book club's character analysis discussion
Timeline Tracker 	• Note all the important events that take place in this section of the text by creating a timeline in your reading log. • Lead your book club's timeline discussion
Discussion Director 	• Note any interesting or important details that you would like to discuss with your group. (Hint: when the narrator tells the reader something directly, *it is probably important*.) • Note any places where the author seems to be sending a message about life or human nature. • Lead your book club's discussion of questions about the text.

The date of our next book club meeting is...	For our next book club meeting, I will read...	My role in the next book club meeting is...	To prepare for that role, I will...

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Independent Reading Calendar

Month: _____

S	M	T	W	Th	F	S

"The Making of a Scientist" Evidence Chart

Example	Summary	Lesson
Tiles		
Dinosaurs		
Birds		

Wagon		

Main Idea

_____

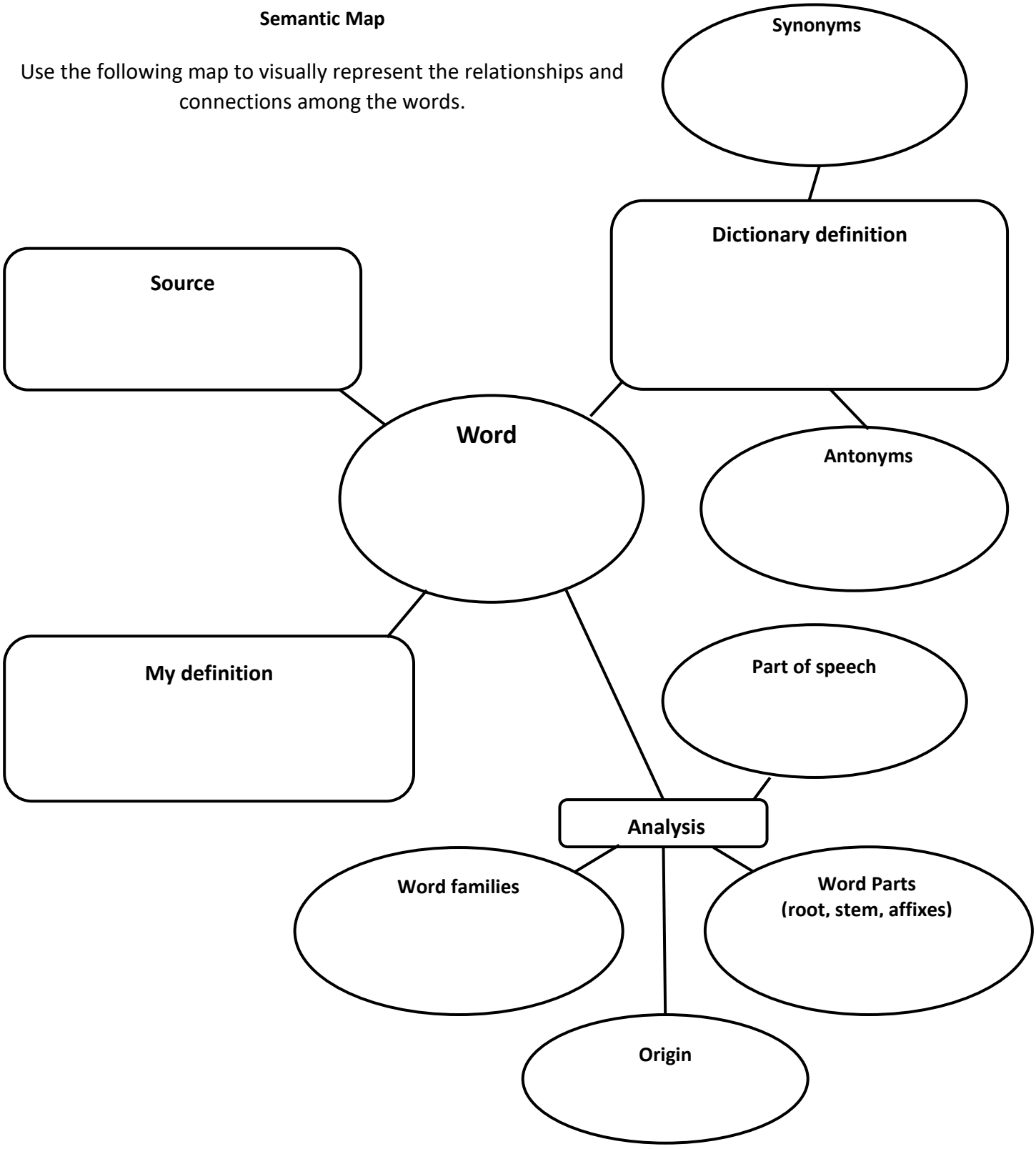
_____

_____

_____

Semantic Map

Use the following map to visually represent the relationships and connections among the words.



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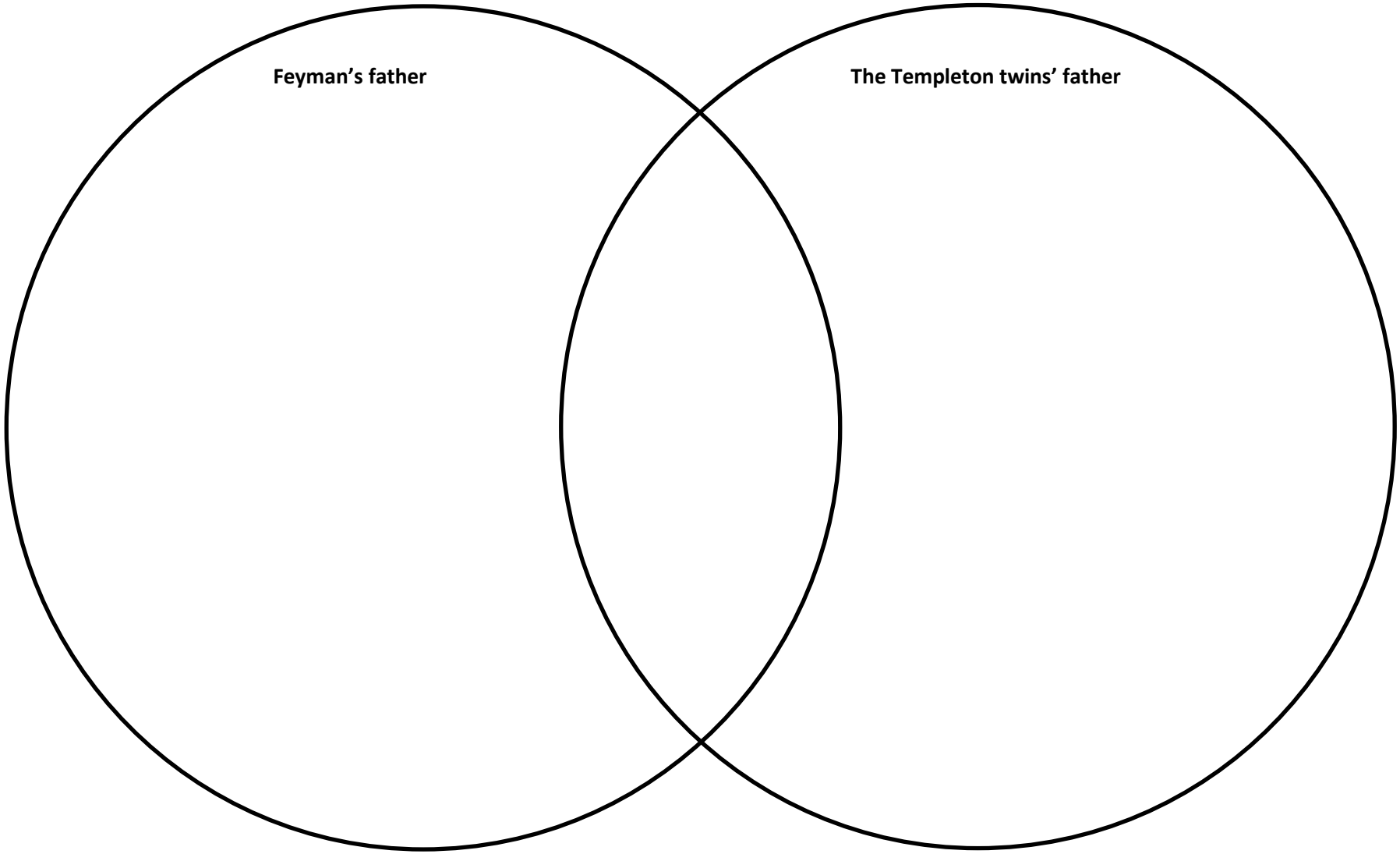
Compare and Contrast



Scientific Thinking

According to "Think science!" people engage in scientific thinking everyday. The article suggests we think like scientists when we wonder. We think like scientists when we see "something surprising and [try] to figure out how it happened" or we seek "out more evidence" which can help us prove or disprove our original thoughts about how something may have happened. We also think like scientists when we "come up with a new explanation for a mystery." For example, "Perhaps [you see] a magician make his assistant disappear from a box and [wonder] if the trick [involves] a trap door. [So, you look] for a joint in the floor beneath the box." When you don't see one, you develop a new explanation, such as "Perhaps the trick used a mirror to reflect an image of an empty wall" ("Think science!")

How can you think like a scientist?

Thinking like a scientist requires having knowledge and engaging in a process. Read more about how to develop the thinking habits scientist use.

Knowledge: Scientists learn about the facts, laws, theories, and ideas which describe the world around us and how it works. Scientists study this information to learn more about what they are observing and to further explore and challenge what other scientists have explored before.

Process: Scientists also study of physical and natural world through observation and experiment. Scientists engage in a process of discovery or inquiry to refine their thinking and develop an understanding of the world around them. They observe the physical and natural world, think about why things exist and act they way they do, develop an idea or hypothesis to explain their thoughts, engage in various experiments to test their original thoughts, and make connections and draw conclusions about the evidence they uncover ("What is science?").

What is scientific inquiry?

Scientific inquiry is the process through which scientists understand the world around them. The process involves:

- asking questions,
- engaging in a process to answer those questions (e.g., conducting an experiment or collecting evidence),
- drawing conclusions about the resulting information or data,
- developing an explanation based on those conclusions, and
- communicating and defending the explanation ("Scientific Inquiry").

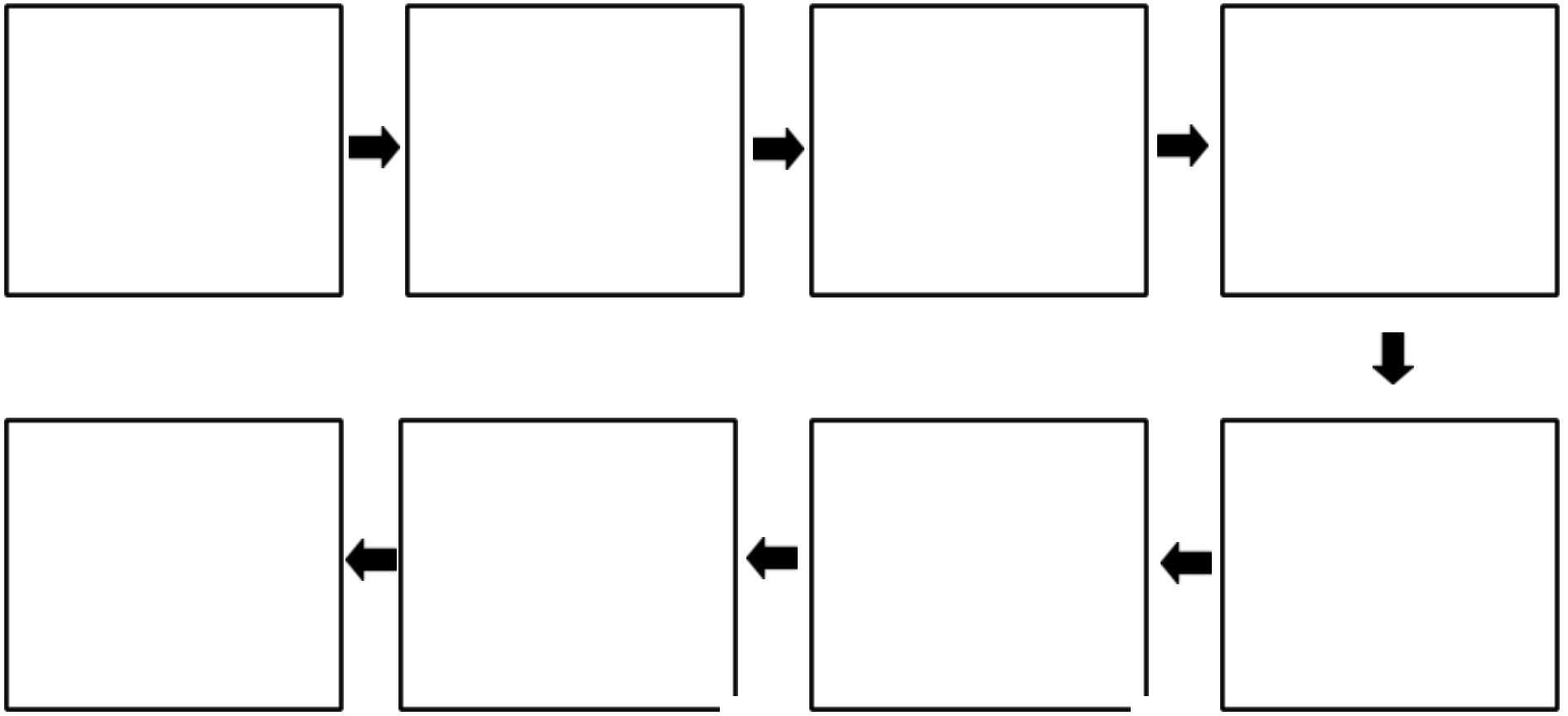
Scientific Terminology

- data: facts, information, or statistics collected and used to analyze or determine something
- evidence: facts or information which show that something exists or an idea or belief is true or valid
- hypothesis: a testable statement or idea; for example, “Eating chocolate daily does not affect a person’s weight.”
- law: a widely accepted hypothesis or a statement about the physical or natural world which is observed through repeated experiments. Scientific laws can predict the outcome of certain experiments--they always work when the same conditions are applied. For example, if you drop an apple from building in the same way under the same conditions, the laws of gravity will apply and the results will likely be the same each time.
- theory: a general principle or body of principles that explain the physical or natural world. Theories come from hypotheses and laws that have been tested many times under different conditions with accurate results. When new knowledge is observed, theories can be revised to explain the new information.
- valid: reasonable or acceptable

Scientific Process Flowchart

Sequence of Events

Main Idea



Choose one lesson Feynman's father taught him in "The Making of a Scientist," and describe how that lesson reflects the process of scientific inquiry.

How has our thinking about the number of planets changed over time? How does this reflect the process of scientific inquiry?

How do Galileo's accomplishments reflect the process of scientific inquiry?

How did Isaac Newton contribute to the process of scientific inquiry?

Works Cited

"Scientific Inquiry." *NSTA Position Statement*. National Science Teachers Association, Oct. 2004. Web. 10 Jan. 2016. <http://www.nsta.org/about/positions/inquiry.aspx>.

"Think science!" *Understanding Science*. University of California Museum of Paleontology. Web. 9 Jan. 2016 <http://undsci.berkeley.edu/article/0_0_0/think_science>.

"What is science?" *Understanding Science*. University of California Museum of Paleontology. Web. 9 Jan. 2016 <http://undsci.berkeley.edu/article/whatisscience_01>.

"The Making of a Scientist" Evidence Chart

Example	Summary	Lesson
Tiles		
Dinosaurs		
Birds		

Wagon		

Main Idea _____

_____

_____

_____

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"Modern Science: What's Changing?" Evidence Chart

Main Idea: _____

_____

Key Detail (quotation or paraphrase)	**How does this evidence relate to the main idea?**

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Presentation Rubric

	3	2	1
Demonstration of understanding	The presentation addresses all elements of the task and effectively demonstrates understanding of the topic, text(s), or findings.	The presentation partially addresses the task and generally demonstrates understanding of the topic, text(s), or findings.	The presentation does not address the task or demonstrates a lack of understanding of the topic, text(s), or findings.
Organization and development of presentation	The presentation is clearly and logically organized with appropriate and relevant facts or descriptive details that support the main ideas or message of the presentation.	The presentation is organized and with a main idea or message and some facts or details.	The presentation is disorganized or lacks a main idea, message, and/or supporting facts/details.
Delivery of presentation	Speaker speaks clearly at an understandable pace.	Speaker makes eye contact and can be generally heard and understood.	Speaker sometimes makes eye contact and is generally difficult to understand.

Vocabulary Chart

Keep a list of words you have learned throughout the unit.

Word	My Definition	Synonyms, Antonyms, and Similar Words (Word Family)	Source Sentence

Word	My Definition	Synonyms, Antonyms, and Similar Words (Word Family)	Picture and Source Sentence

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Evidence Chart for 13 Planets

Main Idea: _____

_____

_____

Section of Text	Key Detail (quotation or paraphrase)	How does this evidence relate to the main idea?

	Planet Type: _____	Planet Type: _____	Planet Type: _____
SIZE			
DENSITY			
COMPOSITION			

Sentence Syntax Handout

For each example:

- **Highlight the subject of the sentence in one color.**
- **Highlight the information about the subject in another color.**
- **Circle the comma.**
- **Write a mini-outline of the information in the sentence.**

"Bright enough to cast shadows on Earth at night, Venus has long been considered Earth's 'twin.'" From "Venus," *13 Planets*	
"However, surrounded by clouds of deadly sulfuric acid 40 miles (65 km) thick, lit by 100-million-volt lightning bolts, and covered by thousands of volcanoes, Venus might be considered Earth's evil twin." From "Venus," *13 Planets*	
"Trapping incoming sunlight with a runaway greenhouse effect, these clouds create surface temperatures of 870 degrees F that would melt lead." From "Venus," *13 Planets*	
Now write a sentence with an introductory clause about one of the chapters you read last night. Use this format: [information about the subject],	

[subject] [information about the subject].	

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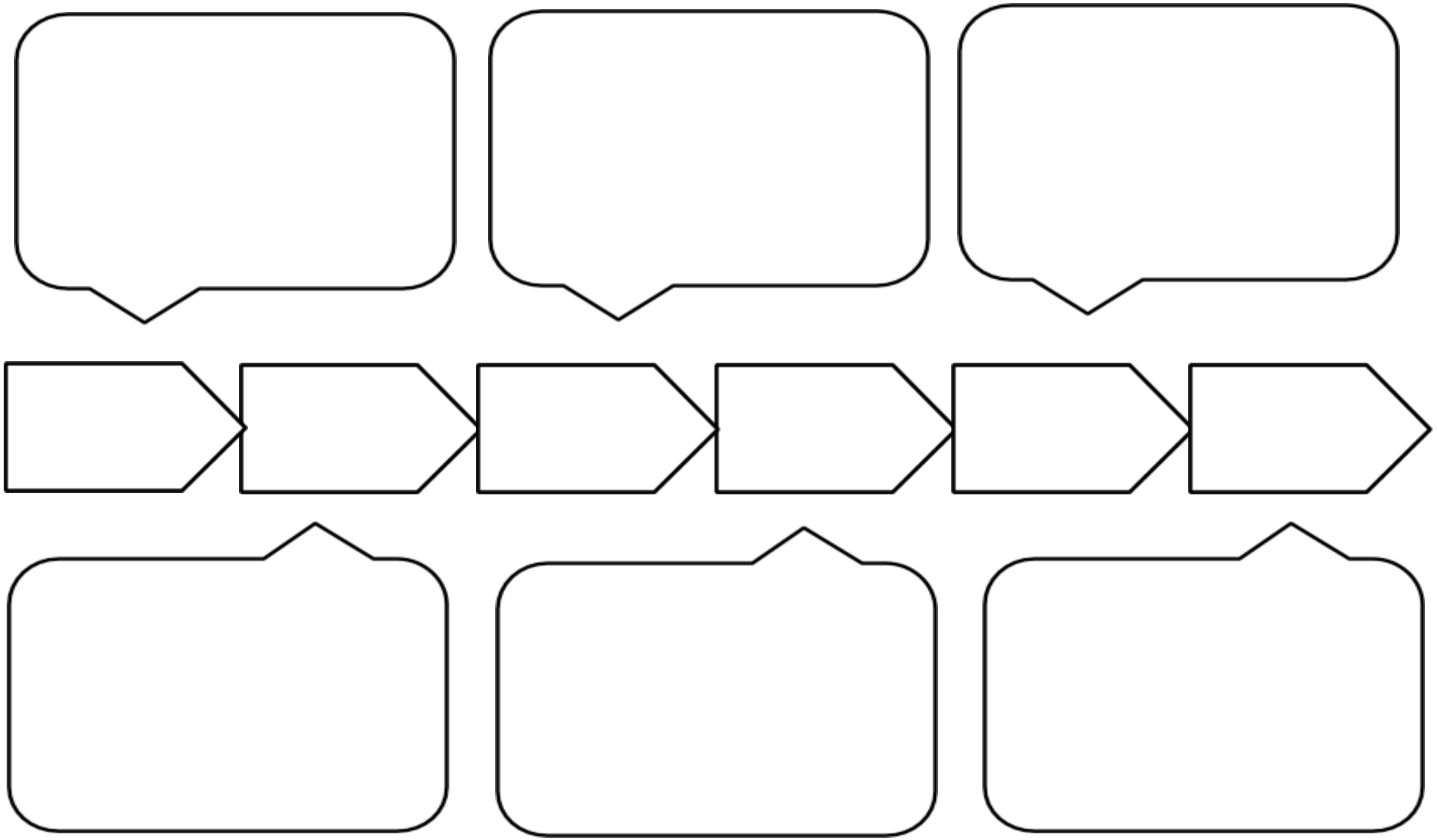
Scientific Process Evidence Chart

Section of Text	Key Detail (quotation or paraphrase)	How does this detail reflect the process of scientific inquiry?
Group 1: Mercury, Venus, Earth, Earth's Moon, Meteorites		
Group 2: Mars, Water on Mars, Ceres/Asteroid Belt		
Jupiter, Jupiter's Moons, Saturn, Saturn's Moons, Uranus		
Haumea/Kuiper Belt, Makemake, Eris/Dwarfs and Comets/Oort Cloud		

Topic-Evidence-Explanation Paragraph Frame

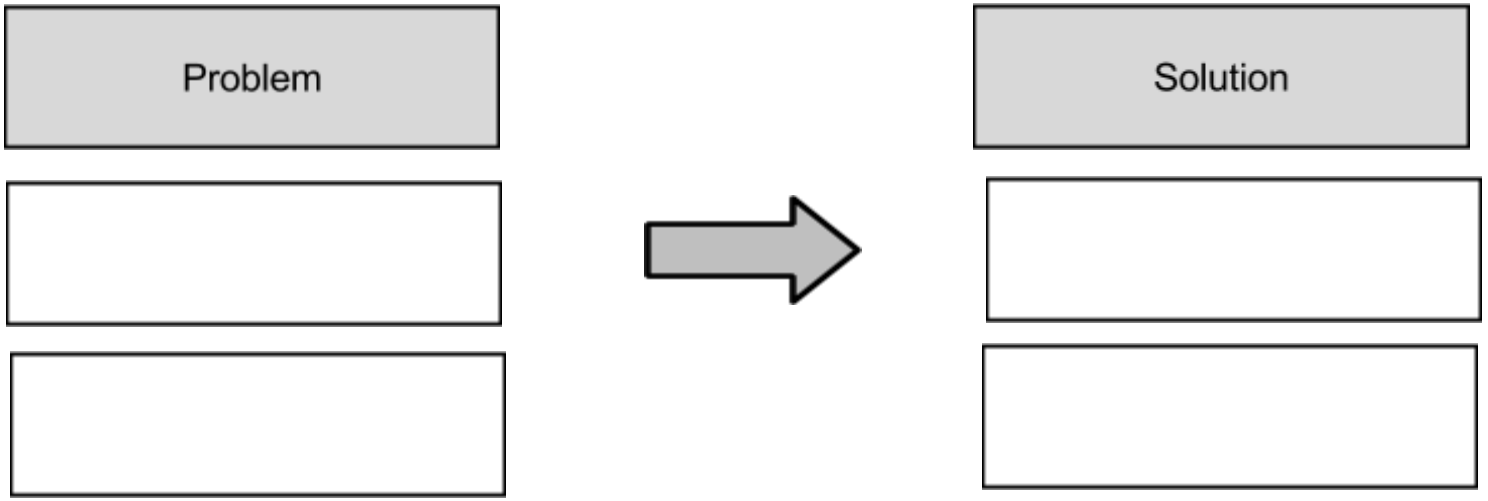
	Question to Prompt My Thinking	Sentence Frame
Topic	• What do I know, based on the text? • What is my response to the question?	• Flip the question into a statement.
Evidence	• How do I know this? • What in the text tells me this?	• In the text it says, "_____." • For example, _____.
Explanation	• Why does the evidence support the topic sentence?	• This shows that _____. • This means that _____. • From this, I can conclude _____.

Chronological Outline:
"Galileo Galilei: Biography, Inventions and Other Facts"



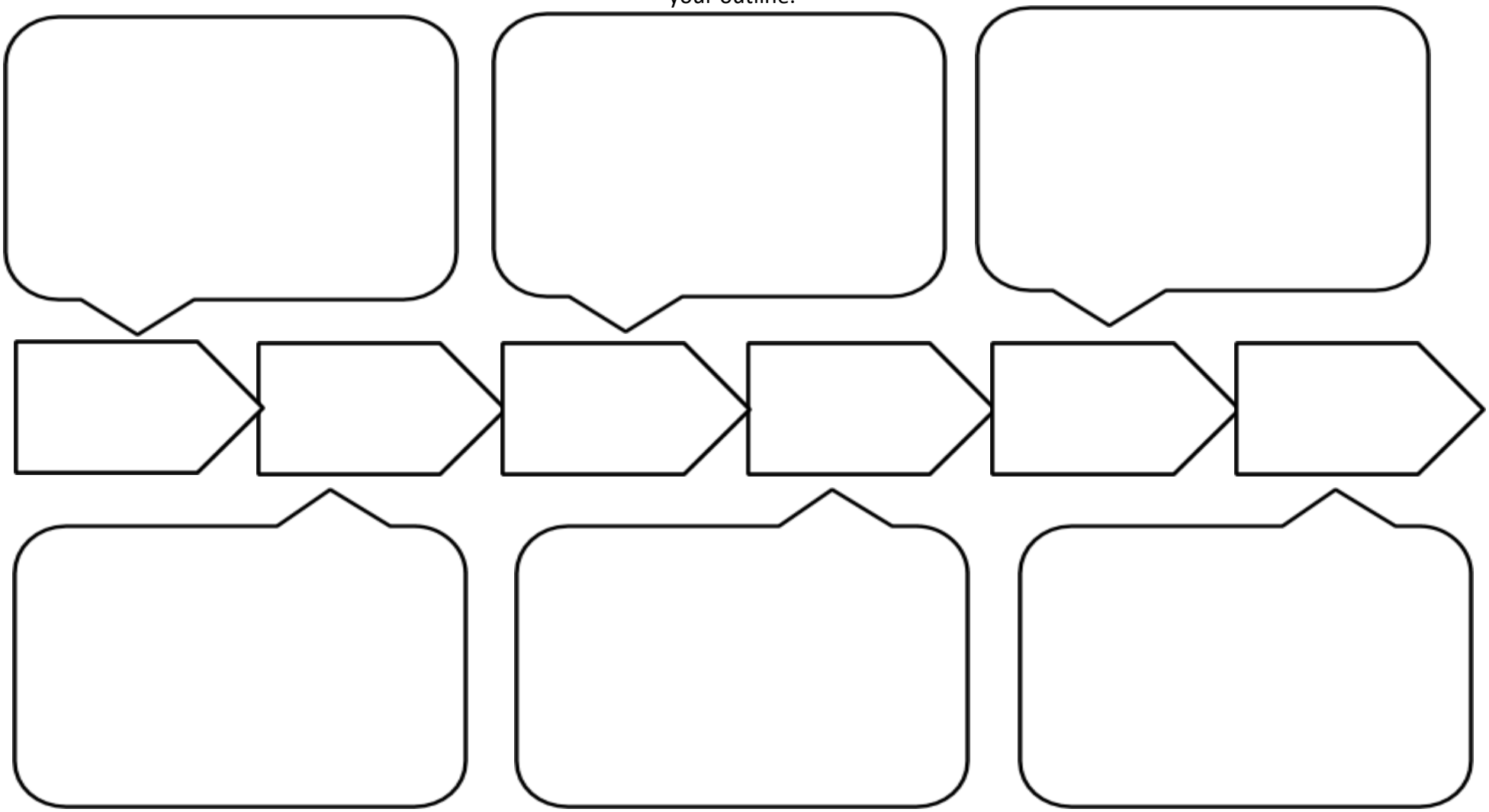
Problem/Solution Outline:

“Hunting the Edge of Space”



Chronological Outline:
How has telescope technology evolved over time?

Directions: Use information from the article, “Galileo Biography, Inventions and Other Facts”, and the video “Hunting the Edge of Space” to inform your outline.



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Strategies to Support a Claim

Claim: Galileo discovered Neptune.

Strategy used to support the claim	Example of that strategy (quotation or paraphrase)
	• •
	• •
	• •

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Fluency Tracker

Self-Assessment:	Did Great!	Needs Work
Accuracy - I read all of the words correctly.		
Rate - I read at a good speed, like when I talk		
Expression - I made my reading sound interesting, like when I tell a story.		
Phrasing and Punctuation - I read the punctuation.		

Group Member Name:	Did Great!	Needs Work
Accuracy - I read all of the words correctly.		
Rate - I read at a good speed, like when I talk		
Expression - I made my reading sound interesting, like when I tell a story.		
Phrasing and Punctuation - I read the punctuation.		

Group Member Name:	Did Great!	Needs Work
Accuracy - I read all of the words correctly.		
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Group Member Name:	Did Great!	Needs Work
Accuracy - I read all of the words correctly.		
Rate - I read at a good speed, like when I talk		
Expression - I made my reading sound interesting, like when I tell a story.		
Phrasing and Punctuation - I read the punctuation.		

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Discussion Tracker

Accountable Talk: Did Newton or Galileo make a greater contribution to the way we see a telescope today?

Fill in student names prior to the seminar. Capture your notes about each student's participation and knowledge.

Student Name	Draws on preparation and other information to support ideas in discussion and demonstrate understanding	Uses conversation stems	Continues conversation by posing and responding to questions, connecting ideas, and reviewing and explaining ideas

Culminating Writing Task Directions

Consider two of the examples Richard Feynman points out in his memoir: the birds, and the wagon. What lesson was Feynman's father trying to teach Richard about science through one of these two examples?

To answer this question:

- Select one of the examples: the birds or the wagon.
- Summarize the example as told by Feynman in "The Making of a Scientist."
- Identify how Richard's thinking changed throughout the selected example.
- Determine the lesson Feynman's father was trying to teach Richard through the example.
- Describe the process of scientific inquiry.
- Compare the process Feynman's father uses and the lesson he tries to teach in the selected example to the process of scientific inquiry.

Write an essay that identifies and explains the lesson Richard Feynman's father was trying to teach Richard about science, using examples, details, and quotations to develop the explanation. Be sure to use proper grammar, conventions, spelling, and grade-appropriate words and phrases, including words that signal relationships (e.g., *however*, *although*, *moreover*, *in addition*, etc.).

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Culminating Writing Task Rubric

	3	2	1	0
Reading and Understanding Text	• Shows **full comprehension** of ideas both explicit and inferential indicated by grade-level reading standards • **Accurate** reasoning is demonstrated through **ample** textual evidence	• Shows **comprehension** of ideas indicated by grade-level reading standards • **Mostly accurate** reasoning is demonstrated through **adequate** textual evidence	• Shows **limited comprehension** of ideas indicated by grade-level reading standards • **Minimally accurate** reasoning is demonstrated through **minimal** textual evidence	• Shows **no comprehension** of ideas indicated by grade-level reading standards • **Inaccurate or no** reasoning is demonstrated with **little or no** textual evidence
Writing about Text	• Addresses the prompt and **clearly** introduces and states an opinion or topic • Development is cohesive and **logically** organized with **clear** support • Language links ideas and **consistently** demonstrates awareness of purpose and audience	• Addresses the prompt and states an opinion or topic • Development is organized with **some** support and cohesion • Language links ideas and demonstrates awareness of purpose and audience	• Addresses the prompt and has an introduction • Development and support are **minimal** • Response has **limited** coherence and/or cohesion • Language demonstrates **limited** awareness of purpose or audience	• Does not address the prompt • **Lacks** organization, is **undeveloped**, and **does not** provide support • Language demonstrates **no** awareness of purpose or audience
Language Conventions	• **Full command** of conventions indicated by grade-level standards • **Few minor errors** do not interfere with meaning	• **Some command** of conventions indicated by grade-level standards • **May have errors** that occasionally interfere with meaning	• **Limited command** of conventions indicated by grade-level standards • **Errors** often interfere with meaning	• **No command** of conventions indicated by grade-level standards • **Frequent and varied errors** interfere with meaning

Linking Words and Phrases

Sequence Words (What happened next?)	Contrast Words (And now for something different…)	Adding On Words (More about that…)
Subsequently Consequently	However Although Nevertheless In contrast	Especially Similarly Moreover In addition

Directions: Add linking words and phrases to connect ideas in the paragraph below:

One example from the text is when Feynman's father teaches him about birds. Feynman's father doesn't think it's important to know the bird's name. He thinks it's important to know what the bird is doing. He thinks it's important to ask questions. Feynman and his father ask why the birds are pecking at their feathers. Feynman provides a theory for the pecking: "Maybe they mess up their feathers when they fly, so they're pecking them in order to straighten them out." Feynman and his father observe the birds to test out this theory. Feynman's idea turns out to be incorrect. His thinking changes.

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Evidence Chart for *Isaac Newton*

Main Idea 1: _____

_____

_____

Section of Text	Key Detail (quotation or paraphrase)	How does this evidence relate to the main idea?

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Evidence Chart

Main Idea 2: _____

_____

Key Detail (quotation or paraphrase)	**How does this evidence relate to the main idea?**

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Extension Task Rubric

	3	2	1	0
Reading and Understanding Text	• Shows **full comprehension** of ideas both explicit and inferential indicated by grade-level reading standards • **Accurate** reasoning is demonstrated through **ample** textual evidence	• Shows **comprehension** of ideas indicated by grade-level reading standards • **Mostly accurate** reasoning is demonstrated through **adequate** textual evidence	• Shows **limited comprehension** of ideas indicated by grade-level reading standards • **Minimally accurate** reasoning is demonstrated through **minimal** textual evidence	• Shows **no comprehension** of ideas indicated by grade-level reading standards • **Inaccurate or no** reasoning is demonstrated with **little or no** textual evidence
Writing about Text	• Addresses the prompt and **clearly** introduces and states an opinion or topic • Development is cohesive and **logically** organized with **clear** support • Language links ideas and **consistently** demonstrates awareness of purpose and audience	• Addresses the prompt and states an opinion or topic • Development is organized with **some** support and cohesion • Language links ideas and demonstrates awareness of purpose and audience	• Addresses the prompt and has an introduction • Development and support are **minimal** • Response has **limited** coherence and/or cohesion • Language demonstrates **limited** awareness of purpose or audience	• Does not address the prompt • **Lacks** organization, is **undeveloped**, and **does not** provide support • Language demonstrates **no** awareness of purpose or audience
Language Conventions	• **Full command** of conventions indicated by grade-level standards • **Few minor errors** do not interfere with meaning	• **Some command** of conventions indicated by grade-level standards • **May have errors** that occasionally interfere with meaning	• **Limited command** of conventions indicated by grade-level standards • **Errors** often interfere with meaning	• **No command** of conventions indicated by grade-level standards • **Frequent and varied errors** interfere with meaning