

## Welcome Teachers and Administrators!

With great excitement, we present this year's All Pikes Peak Reads curriculum! There have been many changes in the lesson structure this year. Primarily, we have simplified the lessons, with three over-riding goals:

1. To provide teachers with lessons that are manageable with regard to both time and materials;
2. To create lessons that are relevant to the Colorado State Standards; and
3. To create lessons that engage students in the Space subject overall and with the chosen books in particular.

If you catch yourself wishing for more material, you will find it on the PPLD website ( [www.ppld.org/appr](http://www.ppld.org/appr) ). At this site, you can get a calendar of all of the APPR events that run from September 20-October 30, including information about visits from David Silver of the Heinlein Society and Homer Hickam, author of *Rocket Boys*. You will also find links to sites that give more information about the authors and the books chosen for APPR this year ( [www.heinleinsociety.org](http://www.heinleinsociety.org) [www.homerhickam.com](http://www.homerhickam.com) ).

Also at the PPLD website, you can download any and all APPR lessons. In other words, if you are teaching at the 6-8 level and need to differentiate for a struggling student, you can go right to the 3-5 level. If you need to differentiate for an advanced student, check out the 9-12 work. (In fact, all APPR lessons are free and available to the public.)

Another exciting feature of this year's curriculum is that the K-5 lessons are designed to allow for an **all-school read!** (A hearty thank-you goes to APPR writer Kelly Moeller for this awesome idea!) The K-2 lessons align very nicely with those written for the 3-5 students. We hope that this structure allows for a community experience with such things as book discussion groups, shared activities, science fairs, and school-wide displays of student work.

Writing standards-based lessons that are engaging for students throughout the Pikes Peak region is no easy task! You may find spots where we miss the mark, but we truly hope that the new lesson format will serve you and your students. Feel free to send feedback directly to those of us involved in the writing and editing of the work (see info below), or send your feedback to PPLD.

Best of luck in Space this year!  
Cheri Colburn

## Lesson Structure

Where possible, the lessons are arranged so that the first page contains the standards, the lesson overview, and the lesson objectives—a fairly comprehensive preview of the lesson. Here is a description of each of those elements:

### **State standards**

Every lesson begins with Colorado State standards for the targeted subject areas (either ELA and Social Studies or Math and Science). Next comes Art or Music standard and the Writing standard that the lesson addresses. The art and music information is provided to appeal to all types of learners; the writing information is provided to allow for writing-across-the-curriculum opportunities. Along with the standards, benchmarks are identified. You may notice that for better fit on the page, we often removed “for example” statements from the standards/benchmarks.

### **Lesson Overview**

This section provides a brief summary of the lesson. The overview is step-by-step, but it is very general.

### **Learning Objectives**

This section articulates the connection between the lesson activities and the standards being addressed.

### **The Lesson: Before, During, and After**

Lessons are divided into three sections. The **Before** section provides information about the APPR books. (For example: “Students read (or listen to) pages 1-30 in the nonfiction book *Space*.”) This section also introduces any vocabulary that may prove problematic. (Vocabulary is not leveled with regard to literacy/grade levels but is instead focused on comprehension.) Finally, the Before section identifies materials that should be on hand and teacher prep work that will need to be completed prior to beginning the lesson.

The **During** section provides a step-by-step breakdown of the activity. Some teacher scripting and expected student responses are included. These features are designed to be pragmatic. We have included them where we thought they might be useful, but you won’t find them at every step in every activity. (Teacher scripting is printed in italics to distinguish it from the rest of the lesson.)

The **After** section usually provides some kind of whole-group activity designed to help summarize and deepen the learning and to allow for sharing of student products.

### **Differentiation**

This section suggests simple ways that the lesson can be differentiated for advanced students and for struggling students.

### **ELL Feature**

Here we note how the lesson already addresses the learning needs of English Language Learners or how it can be differentiated for ELLs.

## **Other Space Titles**

The hope here is that students will want to investigate the subject of Space more deeply. If they do, they can find other space titles that should be manageable for students at the lesson level. Notes are provided that describe the suggested books.

## **Space Websites**

Again, we are hoping students will want to delve deeper. These websites provide more Space content. A description of the website is provided.

## **Notes from the Writing Team**

### **Dee Vazquez: APPR Co-Chair**

Each year as we look at the wealth of information we can use to build projects and study modules for our program, we encounter wonderful people who wish to contribute and fantastic resources that we can include. It is our wish that you would find exactly what you need to become involved in the Read: in the classroom, in your home, or in your community group. Please take a moment and share your thoughts or your experiences with us. You will find a form on the All Pikes Peak Reads web page or email us directly at [appr@ppld.org](mailto:appr@ppld.org).

### **Cheri Colburn: Managing Editor**

I have worked for several years in the educational publishing industry, and during that time, I've worn many hats—copy editor, content editor, writer, and managing editor. With the APPR project, I have worn each of these hats at different times. It has been a pleasure to work with the fine people involved in this project and to help to develop the new lesson structure for APPR. I truly hope the new approach will allow for region-wide participation in All Pikes Peak Reads. I'd love to hear from you! Please send comments, questions, and suggestions for next year to: [colburnwordsmithing@hotmail.com](mailto:colburnwordsmithing@hotmail.com)

### **Kelly Moeller: Math and Science**

"What I did on my summer vacation" has taken on a whole new meaning this year! As an 11-year veteran of science teaching at Timberview Middle School in Academy District 20, I have learned a lot about the writing side of curriculum development. I hope you find the math/science lessons easy to use, with very few alterations necessary. Please drop me a line, [kelly.moeller@asd20.org](mailto:kelly.moeller@asd20.org), to let me know much your kids enjoyed the activities. I am excited to attend the special events planned for All Pikes Peak Reads!

### **Travis Duncan: ELA and Social Studies**

The first building I ever walked into in Colorado Springs was the East Library, right after the kick-off of the first All Pikes Peak Reads. *To Kill a Mockingbird* displays and information about APPR were everywhere. Attending book discussion groups and other APPR-related programs was great way to meet people in town. Now, seven years later, I consider it a real privilege to have been involved in shaping the curriculum guide for this year's APPR. I'd love to hear your comments and questions. E-mail me at [travisduncan23@gmail.com](mailto:travisduncan23@gmail.com). (Travis wrote in alongside and with the assistance of his wife, Frances Gomez, who is currently enrolled at the University of Colorado, Colorado Springs in the school counseling program. She has studied comprehensive curriculum instruction, and her contributions were essential to the quality lessons that Travis produced. You can contact Frances Gomez at: [fgomez@tangle.com](mailto:fgomez@tangle.com).)

# 6-8 APPR Curriculum

## ELA and History

### **Lesson 1: Social Organization: Then and Now**

ELA Standard 1: Students read and understand a variety of materials.

History Standard 3: Students understand that societies are diverse and have changed over time.

3.2: Students understand the history of social organization in various societies.

Writing Standard 1: Students read and understand a variety of materials.

Music Standard 5: Students will relate music to various historical and cultural traditions.

### **Lesson 2: The Pros and Cons of Technological Progress**

ELA Standard 1: Students read and understand a variety of materials.

History Standard 4: Students understand how science, technology, and economic activity have developed, changed, and affected societies throughout history. 4.1: Students understand the impact of scientific and technological developments on individuals and societies.

Writing Standard 2: Students write and speak for a variety of purposes and audiences.

Art Standard 1: Students recognize and use the visual arts as a form of communication.

### **Lesson 3: Mines on the Moon**

ELA Standard 5: Students read to locate, select, and make use of relevant information from a variety of media, references, and technological sources.

History Standard 5: Students understand political institutions and theories that have developed and changed over time. 5.4: Students know the history of relationships among different political powers and the development of international relations.

Writing Standard 1: Students read and understand a variety of materials.

Art Standard 1: Students recognize and use the visual arts as a form of communication.

## Math and Science

### **Lesson 1: Moon Camp Memoirs**

Math Standard 1: Students develop sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.

Science Standard 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space (*Focus: Geology, Meteorology, Astronomy, Oceanography*).

Writing Standard 2: Students write and speak for a variety of purposes and audiences.

Music Standard 4: Students will listen to, analyze, evaluate, and describe music.

### **Lesson 2: Rocket Altitude**

Math Standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

Science Standard 2: Physical Science: Students know and understand common properties, forms and changes in matter and energy. (Focus: Physics and Chemistry)

Writing Standard 2: Students write and speak for a variety of purposes and audiences.

Music Standard 4: Students will listen to, analyze, evaluate, and describe music.

### **Lesson 3: Film Canister Rockets**

Math standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

Science Standard 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

Writing Standard 2: Students write and speak for a variety of purposes and audiences.

Art Standard 3: Students know and apply visual arts materials, tools, techniques, and processes.

## All Pikes Peak Reads

### 6-8 ELA and History

#### Lesson 1: Social Organization: Then and Now

Texts: *Rocket Boys* by Homer H. Hickam, Jr.  
*The Space Tourist's Handbook* by Eric Anderson

#### **ELA Standard**

Standard 1: Students read and understand a variety of materials.

##### Benchmarks

- using a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels in addition to the types of reading material mentioned above. Students extend their thinking and understanding as they read stories about people from similar and different backgrounds.

#### **History Standard**

Standard 3: Students understand that societies are diverse and have changed over time.

3.2: Students understand the history of social organization in various societies.

##### Benchmarks

- Describing and giving examples of basic elements of culture and social organization;
- Explaining how forces of tradition have acted to maintain elements of social organization throughout history;
- Comparing how roles of people have differed throughout history based on various factors (*for example, gender, age, caste, racial identity, wealth, and/or social position*); and
- Describing how social roles and the characteristics of social organization have both changed and endured in the United States throughout its history.

#### **Writing Standard**

Standard 1: Students read and understand a variety of materials.

##### 5-8 Benchmark

- using a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels in addition to the types of reading material mentioned above. Students extend their thinking and understanding as they read stories about people from similar and different backgrounds.

#### **Music Standard**

Standard 5: Students will relate music to various historical and cultural traditions.

##### Benchmarks

- Describing how distinguishing elements of music are used in examples from various cultures
- Describing the roles of musicians throughout history and in various cultures.

#### **Lesson Overview**

1. Students discuss roles they hold as individuals in society (gender, age, class, race).
2. Students discuss what those roles look like in *Rocket Boys*.
3. Students work in groups of four to list as many kinds of social roles and systems of social organization they can find in *Rocket Boys*.
4. Students write an essay using examples from *Rocket Boys* of ways in which social organization in Coalwood, West Virginia are similar and/or different from their lives.

#### **Learning Objectives**

1. use text to self strategies to understand the reading

2. Discuss the social roles and ways in which the town of Coalwood, West Virginia was organized around those roles there in the late 1950s.
3. summarize the lesson by writing an essay comparing and contrasting social roles and characteristics of social organization now vs. West Virginia in the 1950s.

## **Before**

1. Students read pages 1-119 in *Rocket Boys*.
2. Students read pages 10-13 of *The Space Tourist's Handbook*.
3. **Preview vocabulary**  
From *Rocket Boys*  
tipple (p. 1): *Mining*. a structure where coal is cleaned and loaded in railroad cars or trucks.  
paregoric (p. 8): any soothing medicine; anodyne.  
Chagrined (pg. 82): a feeling of vexation, marked by disappointment or humiliation.  
Prodigious (p. 85): wonderful or marvelous: *a prodigious feat*  
pernicious (p. 88): causing insidious harm or ruin; ruinous; injurious; hurtful: *pernicious teachings; a pernicious lie*.  
cupidity (p. 89): eager or excessive desire, esp. to possess something; greed; avarice  
From *The Space Tourist's Handbook*  
sub-orbital (p. 10): (of a spacecraft) not in orbit; not achieving an altitude and velocity resulting in a ballistic trajectory circling the earth at least once.
4. **Gather materials**  
White board and markers  
Pencil and paper for students  
CD player or computer with speakers

## **During**

### **Discussion**

1. Explain what social roles are. Say: *Whether you know it or not, each one of you has a social role that is defined by things like the place where you live, your age, your gender and even by what your parents do for a living.* (Discuss students' roles.)
2. *All of these roles are also in Rocket Boys. For instance, in our city, people have lots of different jobs in lots of different industries. Who can tell me what industry holds the town of Coalwood together?* (It is a coal mining town. All the jobs revolve around the mine. Once the coal is gone, the town will cease to exist.)
3. *On page 11, Sonny says the books he read as a child did not allow him to imagine a future outside of Coalwood. The Russians' launch of Sputnik (pg. 16) did. What event might change your life the way the launch of Sputnik changed Sonny's? How might living in Coalwood be limiting?* (Little diversity, no exposure to other choices, pressure from Sonny's dad to go into mining as the only option.)
4. *All of you have hobbies. Think about the hobbies of the characters in the book. On page 111, we read about how the "Football Fathers," unwittingly caused Big Creek to not be able to play the following season. The athletes lost their social roles. What do you think that will mean for the athletes, as well as for the Rocket Boys?*
5. *Think about what it means to be a company man vs. a union man. (Pages 49-51, 54 – 58) We learned about the history of union workers vs. coal companies through the roles of Mr. Dubonnet and Homer Hickam. How does Sonny's dad being a company man affect his and relationships? What are the advantages and disadvantages for Sonny? (Sonny can get the supplies he needs because of his father's position. But some miners—like Pooky Suggs—don't like Sonny because of his father.)*
6. *Think about your gender and how it affects the way you interact with the world. At the school auditorium on page 111, Principal Turner lists appropriate occupations for males and females. Is this the kind of speech you can imagine our principal making today? Why or why not? How do you think it affected students to hear what occupations their genders are suited for?*
7. Gender is also an issue in *The Space Tourist's Handbook*. In 1963, Russian Cosmonaut Valentina Tereshkova became the first woman in space. The United

States wouldn't send a woman into space until twenty years later (1983, Sally Ride). Say: *Think about attitudes toward women in Coalwood and how those attitudes was representative of attitudes about gender in the United States as a whole. How have these things changed? Do you think that the genders are still expected to go into specific professions?*

8. **Essay:** Students write a compare/contrast essay that looks at their lives compared with one or more characters in *Rocket Boys*. Depending upon student proficiency, have them write about one aspect of social roles (ex: gender) or more.

While students work, play a collection of popular mining songs. Low prep: If you have a computer with speakers, head to this Web site, scroll to the bottom, and hit "Play":

<http://new.music.yahoo.com/blogs/yradish/113/coal-mining-songs/>

## **After**

1. Have students break into groups and discuss what they wrote. Which roles did they choose and what similarities/differences did they see?
2. Ask students to share what they discussed in their groups with the rest of the class. Did they learn anything interesting about what it means to be a girl vs. a boy, etc.?

## **Differentiation**

Advanced students can research the history of coal mining in Colorado and write an essay that uses primary and secondary sources to compare and contrast mining in Colorado with mining in other regions. Struggling students can write a compare/contrast paragraph that looks at one aspect of their social roles compared with one aspect of one character in the book.

## **ELL Feature**

Preview unfamiliar vocabulary before a lesson begins. Use actual terms (rather than simplified language) once the terms have been defined.

## **Other Space Titles**

*Growing Up in Coal Country* by Susan Campbell Bartoletti

Publisher: Houghton Mifflin Harcourt (ISBN-13: 9780395778470)

This 128-page book describes, through newspaper articles, interviews, and other sources the life of Pennsylvania coal miners (including child laborers), at the turn of the century.

*Dr. Space: The Life of Werner Von Braun* by Bob Ward

Publisher: Naval Institute Press (ISBN-13: 9781591149262)

This 282-page book describes Werner Von Braun's achievements for the U.S. space effort, including a description of his participation in the V-2 rocket program in Hitler's Nazi Germany.

## **Space Websites**

<http://www.homerhickam.com/students/>

This is the "students" section of Homer Hickam's official Web site. It includes information about *Rocket Boys*, science fairs, the movie "October Sky." Students can send for an autographed picture of Hickam.

[http://en.wikipedia.org/wiki/Wernher\\_von\\_Braun](http://en.wikipedia.org/wiki/Wernher_von_Braun)

Summary: The Wikipedia entry on Werner von Braun is a great source for more information on Homer Hickam's hero.

# All Pikes Peak Reads

## 6-8 ELA and History

### Lesson 2: The Pros and Cons of Technological Progress

Texts: *Rocket Boys* by Homer H. Hickam, Jr.  
*The Space Tourist's Handbook* by Eric Anderson

#### ELA Standard

Standard 1: Students read and understand a variety of materials.

5-8 Benchmark

using a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels in addition to the types of reading material mentioned above.

Students extend their thinking and understanding as they read stories about people from similar and different backgrounds.

#### History Standard

Standard 4: Students understand how science, technology, and economic activity have developed, changed, and affected societies throughout history.

4.1: Students understand the impact of scientific and technological developments on individuals and societies.

Benchmarks:

- explaining the significance of the achievements of individual scientists and inventors from many cultures
- describing and explaining how industrialization influenced the movement of people identifying and explaining the consequences of scientific and technological changes; and
- relating differences in technology to differences in how people live in various regions of the world.

#### Writing Standard

Standard 2: Students write and speak for a variety of purposes and audiences.

Benchmarks:

- writing stories, letters, and reports with greater detail and supporting material;
- choosing vocabulary and figures of speech that communicate clearly;
- drafting, revising, editing, and proofreading for a legible final copy;
- applying skills in analysis, synthesis, evaluation, and explanation to their writing and speaking;
- writing and speaking in the content areas

#### Art Standard

Standard 1: Students recognize and use the visual arts as a form of communication.

Benchmarks:

- identifying and discussing how and why visual images, themes, and ideas communicate;
- selecting, organizing, and employing visual images, themes, and ideas in works of art to express an intended meaning; and
- evaluating meaning and communication in works of art.

#### Lesson Overview

1. Students discuss the impact of scientific and technological developments on individuals and society as they relate to: Sputnik and the space race, coal mining and black lung, and the contributions of rocket scientist Wernher von Braun.
2. Students choose one of these topics to research and discuss in an essay, positive or negative.
3. After hearing opposing essays, students debate whether the ends justify the means for each of these three topics.

## **Learning Objectives**

1. Use text to self strategies to understand the reading
2. Discuss the impacts of technological advancement on individuals and society.
3. Students write a position essay in favor of or against one technological advance.

## **Before**

1. Students read through page 250 of *Rocket Boys*.
2. Students read pages 11-16 of *The Space Tourist's Handbook*.
3. **Preview vocabulary** From *Rocket Boys*  
entropy (p. 135): : the degradation of the matter and energy in the universe to an ultimate state of inert uniformity. A closed system evolves toward a state of maximum entropy. Also: a doctrine of inevitable social decline and degeneration.  
theodolite (p. 163): an instrument for measuring both horizontal and vertical angles, as used in triangulation networks. A key tool in surveying and engineering work; also adapted for use in fields like meteorology and rocket launch technology.
4. **Gather materials**  
White board and markers  
Pencil and paper for students (or obtain access to the computer lab)

## **During:**

### **Discussion**

Say: *All of our lives are impacted by scientific developments. We're going to talk about the impacts of scientific and technological developments in Rocket Boys.* Ask how students use technology in their everyday life. Discuss breakfast: did they use a microwave, drink pasteurized milk? How did they get to school? Do they use a cell phone? The Internet? How would their lives would be different without these things?

### **Sputnik**

(Pages 16-29, 32-33) Say: *You read about how the Russians' launch of the first satellite, changed life for many Americans. Who can name some of the ways Americans reacted to the news?* (Fear. Folks at the company store talked about shooting it down. Principal Turner announced there would be no more easy classes. Some people, like Sonny, saw it as a challenge and a way to escape life as a coal miner.)

### **Continuous Mining and Black Lung**

(Pages 57-59, 175) Say: On page 57 to 59, there is an *argument between Sonny's father and Mr. Dubonnet. What technological change caused miners to begin getting black lung?* (continuous miners) Coal companies extracted more coal and made more money with *continuous miners, but the health of their workers suffered. Sonny's father accused Mr. Dubonnet of being a communist. Why?* (The launch of Sputnik caused fear about the Russians and perhaps unease that Communism was a better form of government.) *What was a positive effect of Americans' fear of Communism?* (The space race and its effects: revamping of schools, inspiring kids like Sonny, America putting a man on the moon in 1969.)

### **Wernher von Braun: Rockets in War and in Peace**

(Pages 29-30, 33-34, 77, 174, 181-182, 191-192) Say: *Wernher von Braun is the most prevalent and ambivalent character in Rocket Boys. He serves as an inspiration to Sonny to begin building rockets. Why is Sonny's father upset that his son has chosen von Braun as a hero?* (von Braun developed V-2 rockets for the Nazis in World War II). *When Sonny asks Mr. Bykovski, a Jewish man, about Wernher von Braun, what does Bykovski tell Sonny?* (That von Braun's sins are not Sonny's. Essentially, rocketry, when used in the service of space exploration, is a noble pursuit.)

## **Essay**

Say: *We've discussed three scientific or technological developments that affected The United States: the first satellite, continuous mining, and the use of rocketry for peace and for war. Choose one of the topics we discussed and research it, taking a position for or against it. Write an essay that presents your viewpoint.* Ask students to include one historical image, acquired during their research of the subject, to share with the class. (For the purpose of the discussion after students write, you may also ensure that a pro and a con essay are written for each of the topics.)

## **After**

3. Have a pro and a con essay presented on one topic.
4. Discuss whether students' views have been changed now that they've learned more.
5. Repeat 1 and 2 as time allows.
6. Have students discuss the selection from *The Space Tourist's Handbook*. Does the future of space seem less threatening now (i.e. space tourism)?

### **Differentiation**

Advanced students can write a longer essay that incorporates all three topics. Struggling students can work on their essay in groups or write paragraphs instead of essays.

### **ELL Feature**

Develop a safe environment by encouraging and rewarding students who risk responding even when they are not certain they're correct.

## **Other Space Titles**

*Red Moon Rising: Sputnik and the Hidden Rivalries that Ignited the Space Age*

By Matthew Brzezinski

Publisher: Henry Holt & Company, Incorporated (ISBN-13: 9780805088588)

This 336-page book brings to life the deep distrust between Russians and Americans that affected the space race.

*Space Flight: The Complete Story from Sputnik to Apollo – and Beyond*

By Giles Sparrow, Buzz Aldrin

Publisher: DK Publishing, Inc. (ISBN-13: 9780756656416)

This 320-page illustrated book covers the 50-year quest to put a man on the moon, beginning with the U.S. and Soviet space race.

## **Space Websites**

[http://www.coalleader.com/continuous\\_mining.htm](http://www.coalleader.com/continuous_mining.htm)

Summary: Simple but interesting site about continuous miners.

[http://en.wikipedia.org/wiki/Space\\_Race](http://en.wikipedia.org/wiki/Space_Race)

Summary: The Wikipedia entry on the space race is informative, with lots of links to other useful resources.

## All Pikes Peak Reads

### 6-8 ELA and History

### Lesson 3: Mines on the Moon

Texts: *Rocket Boys* by Homer H. Hickam, Jr.  
*The Space Tourist's Handbook* by Eric Anderson

#### **ELA Standard**

Standard 5: Students read to locate, select, and make use of relevant information from a variety of media, references, and technological sources.

#### Benchmarks

- using organizational features of electronic information and library and interlibrary catalog databases;
- locating and selecting relevant information;

#### **History Standard**

Standard 5: Students understand political institutions and theories that have developed and changed over time.

5.4: Students know the history of relationships among different political powers and the development of international relations.

#### Benchmarks

- describing how the relationships between the United States and external political powers developed with the growth of the nation; and
- identifying basic patterns of political alliances in the modern world.

#### **Writing Standard**

Standard 1: Students read and understand a variety of materials.

#### 5-8 Benchmark

- using available technology to research and produce an end-product that is accurately documented; and
- giving credit for borrowed information in a bibliography

#### **Art Standard**

Standard 1: Students recognize and use the visual arts as a form of communication.

#### Benchmarks

- identifying and discussing how and why visual images, themes, and ideas communicate;
- selecting, organizing, and employing visual images, themes, and ideas in works of art to express an intended meaning; and
- evaluating meaning and communication in works of art.

#### **Lesson Overview**

1. Students discuss the relationship between the United States and Soviet Union during the Cold War and its relation to the Space Race.
2. Students write an alternate history of the Space Race in which a valuable natural resource is discovered on the moon.
3. Students discuss their essays and the of space exploration: peaceful or contentious.

#### **Learning Objectives**

1. Use text to world strategies to understand the reading
2. Discuss why the relationship between the political powers of the United States and Soviet Union became strained during the Cold War and relate this information to the Space Race.
3. Demonstrate knowledge of political alliances in the modern world by writing an essay which imagines an alternate history of the Space Race, bolstered by research from print, electronic and microfiche documents.

## **Before**

1. Students finish reading *Rocket Boys*.
2. Students read pages 11-16, and 42-44 of *The Space Tourist's Handbook*.

### **3. Preview vocabulary:**

From *Rocket Boys*

contrail (p. 256): a visible condensation of water droplets or ice crystals from the atmosphere, occurring in the wake of an aircraft, rocket, or missile under certain conditions.

ginseng (p. 300): any of several plants of the genus *Panax*, esp. *P. pseudoginseng*, of eastern Asia, or *P. quinquefolius*, of North America, having an aromatic root used medicinally.

Hodgkin's Disease (p. 313): a type of cancer characterized by progressive chronic inflammation and enlargement of the lymph nodes of the neck, armpit, groin, and mesentery, by enlargement of the spleen and occasionally of the liver and the kidneys, and by lymphoid infiltration along the blood vessels.

### **4. Gather materials:**

- White board and markers
- Pencil and paper for students (or time in the computer lab)

## **During**

### **Discussion**

1. *After reading Rocket Boys, we've gotten a good sense of the Space Race and what it looked like for many Americans. Can anyone tell me why the Space Race occurred between the United States and Soviet Union? (Space technology became an important symbol of power in the Cold War—"cold" because there was not direct fighting— largely because of the potential military applications. The term "Space Race" came from the arms race that occurred between the United States and Soviet Union after WWII.)*
2. *Consider the exchange between Sonny and then-Senator John F. Kennedy near the end of Rocket Boys (pg. 336). Who remembers what was said? (Kennedy asks Sonny what he thinks we should do on the Moon. Sonny replies, "We should go there and find out what it's made of and mine it just like we mine coal here in West Virginia.")*
3. *Most of you have seen footage of the Apollo 11 moon landing with astronauts next to an American flag on the moon. (<http://history.nasa.gov/ap11ann/kippsphotos/apollo.html>) What is the symbolism of planting a flag? (It's marks ownership of that place.)*
4. *However, after the U.S. landings on the Moon that occurred between 1969 and 1972, the U.S. disclaimed the right to ownership of any part of the Moon. Why do you think that is?*
5. *Now, I'd like you to imagine an alternative history to the Space Race. What do you think would have happened, if Neil Armstrong, in that first step off the moon, had put his foot down on a giant gold nugget? What if the Moon had a valuable resource, like gold, that would make ownership, exploitation or colonization of it extremely attractive?*
6. **Essay:** *Say: Remember what you read in The Space Tourist's Handbook? Scientists believe that manufacturing facilities located at L5 could send enough energy to Earth via microwaves to supply the needs of the entire US. The presence of ice and*

*valuable minerals on the Moon has already been established. Based on what you read in Rocket Boys, as well as research write an alternate history of the Space Race that demonstrates how you believe the United States and Soviet Union would have taken advantage of the discovery of a valuable natural resource on the moon. (Considerations can include the successes and failures of each country in the Space Race, Capitalism vs. Communism as systems of distributing wealth, and attitudes expressed by United States leaders, like John F. Kennedy, about the reasons space exploration was important.)*

## **After**

As time allows, have students read their essays in class and debate their alternative history with other students.

## **Differentiation**

Advanced students can write a longer essay that addresses modern history as well. For example, in 2007, Russians planted a flag on the seabed under the North Pole, causing a stir about its intentions in the international community. How might conditions in the world now be changed to cause a new Space Race to occur? Struggling students can write an essay that uses less cited sources.

## **ELL Feature**

Develop a safe environment by encouraging and rewarding students who risk responding even when they are not certain they're correct.

## **Other Space Titles**

*Moonrush: Improving Life on Earth with the Moon's Resources* by Dennis Wingo

Publisher: Collector's Guide Publishing (ISBN-13: 9781894959100)

This 264-page book looks at how space exploration, and specifically the Moon, may transform the global economy.

*Moon: Resources, Future Development, and Settlement*

by David G. Schrunk, Burton L. Sharpe, Bonnie L. Cooper

Publisher: Springer-Verlag New York, LLC (ISBN-13: 9780387360553)

This 561-page book describes what it will take for feasible human settlement on the Moon in the coming century.

## **Space Websites**

<http://www.youtube.com/watch?v=pCp2jTtay0w>

Summary: A 4:52 video commemorating the 40<sup>th</sup> anniversary of the Apollo 11 moon landing.

[http://www.space.com/adastra/adastra\\_moon\\_resources\\_050223.html](http://www.space.com/adastra/adastra_moon_resources_050223.html)

Summary: A letter from the author of "Moonrush: Improving Life on Earth with the Moon's resources on the Space.com Web site.

# All Pikes Peak Reads

## 6-8 Math and Science

### Lesson 1: Moon Camp Memoirs

Texts: *Rocket Boys* by Homer H. Hickam Jr.  
*The Space Tourists Handbook* by Eric Anderson and Joshua Piven

#### **Math Standard**

Standard 1: Students develop sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.

#### 5-8 Benchmarks

1. demonstrate meanings for integers, rational numbers, percents, exponents, square roots, and pi ( $\pi$ ) use physical materials and technology in problem-solving situations

#### **Science Standard**

Standard 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space (*Focus: Geology, Meteorology, Astronomy, Oceanography*).

#### 6-8 Benchmarks

13. there are characteristics (components, composition, size) and scientific theories of the origin of the solar system.
16. technology is needed to explore space (*for example: telescopes, spectrosopes, spacecraft, life support systems*)

#### **Writing Standard**

Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.

#### 5-8 Benchmarks

- writing stories, letters, and reports with greater detail and supporting material;
- drafting, revising, editing, and proofreading for a legible final copy;

#### **Music Standard**

Standard 4: Students will listen to, analyze, evaluate, and describe music.

#### 5-8 Benchmarks

- Identifying and examining criteria for evaluating music performances and compositions

#### **Lesson Overview**

1. Students will research facts about the moon.
2. Students will take an imaginary trip to Moon Camp from which they will write a memoir in letter form of the things they saw and did while on the moon.
3. Students will mail their memoirs home to a parent or guardian.

#### **Learning Objectives**

1. Students will learn through research and describe characteristics of the moon.
2. Students will use integers to describe the specific characteristics of the moon.

#### **Before**

1. Students read *The Space Tourist's Handbook* (paying special attention to chapter 5) and read *Rocket Boys*.
2. Schedule one day for library research and one day in the computer lab for writing. If possible, teach this lesson in cooperation with the Language Arts teacher.
3. Ask your librarian to pull Moon resource books for easy student access.
4. If possible, bookmark several websites with information about the moon. The following is a small sample:

- [http://news.nationalgeographic.com/news/2004/07/0714\\_040714\\_moonfacts.html](http://news.nationalgeographic.com/news/2004/07/0714_040714_moonfacts.html)
- <http://www.kidscosmos.org/kid-stuff/moon-facts.html>
- <http://nssdc.gsfc.nasa.gov/planetary/factsheet/moonfact.html>

#### 5. Preview vocabulary:

memoir: a report or record of important events based on the writer's personal knowledge. If possible, read an example letter of a kid writing home from camp.

6. Gather materials: Envelopes and stamps, one for each student.
7. Have students address the envelopes.
8. Make one copy per student of the Student Research and Writing Guide, or copy the guide for use as an overhead.
9. Music Activity: Theme song Many travel companies have signature music. If you ran a moon vacations business, what moon themed song would be your theme? Find a sample at this link: <http://moonlightsys.com/themoon/song.html>

### During

1. Say: *In The Space Tourist's Handbook we learned that someday soon it may be possible for anyone, not just astronauts or the very wealthy, to travel to space. Rocket Boys is a memoir, a record of important events of which the author had personal knowledge. Today you are going to do research about the moon, imagine that you attended a five day Moon Camp and write a memoir in the form of a letter home about your trip to Moon Camp.*
2. *If you travelled to the moon, what would you write home in a letter about your experience?*
3. Give each student a copy of the Student Sheet
4. Allow time for students to research information.
5. Allow time for students to write their letters home.

### After

- Students mail their letters home.

### **Differentiation**

Advanced students can include a paragraph in their letter that describes the vehicles they used or the food they ate. Struggling students can measure fewer variables or write shorter letters.

### **ELL Feature**

ELL students can sequence pictures from the Internet or from books to sequence a short story.

### **Other Space Titles**

*Rocket Men: The Epic Story of the First Men on the Moon* by Craig Nelson

ISBN-13: 9780670021031

Publisher: Penguin Group (USA)

Nelson researched scores of primary documents to produce this thrilling retelling of the race to the moon.

*Moon (DK Eyewitness Books)* by Jacqueline Mitton

ISBN-13: 9780756645427

Publisher: DK Publishing, Inc.

Eye-catching photos with accurate descriptions make this book an easy reference tool for students aged 9-12.

### **Space Websites**

One of private space travels cutting edge promoters is Sir Richard Branson. Visit the website to learn more about how you can book your own space ride.

[www.virgingalactic.com](http://www.virgingalactic.com)

## Student Research and Writing Guide

Objective: Students conduct research about the moon and will write a letter home that describes the work they have been doing.

In your science log, record the following data, using metric measurements.

Daytime High	Gravity
Daytime Low	Distance from Earth
Atmosphere	Moon's Mass
Winds	Moon's Radius
Precipitation	Moon's Density

**In your science log, write three to five statements about each of the following topics.**

1. Craters (shapes, how formed, depth, etc.)
2. Soil/rocks (color, composition, components, size, etc.)
3. Sights (for example: mountains, stars, Earth)
4. Activities (for example: jumping, playing golf, riding in a moon buggy, etc.)

**Write a letter home.**

- Paragraph 1 (opening): Describe the moon; include weather, distance from the Earth and the sights.
- Paragraphs 2, 3, and 4 (body): Describe at least three of your activities. Make sure you describe how these activities are different from the way you do them on Earth due to the gravity difference on the moon.
- Paragraph 5: (closing): Discuss how the moon is different from the Earth (soil, rocks, craters); thank the person that sent you to Moon Camp.
- Extra Credit: Draw and color a picture of you at Moon Camp on the backside of your letter.

# All Pikes Peak Reads

## 6-8 Math and Science

### Lesson 2: Rocket Altitude

Texts: *Rocket Boys* by Homer H. Hickam Jr.  
*The Space Tourists Handbook* by Eric Anderson and Joshua Piven

#### **Math standard**

Standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

#### 5-8 Benchmarks

- 1. read and construct displays of data using appropriate techniques and appropriate technology;

#### **Science standard**

Standard 2: Physical Science: Students know and understand common properties, forms and changes in matter and energy. (Focus: Physics and Chemistry)

#### 6-8 Benchmarks

- 7. quantities (for example: time, distance, mass, force) that characterize moving objects and their interactions within a system (for example: force, speed, velocity, potential energy, kinetic energy) can be described, measured and calculated

#### **Writing Standard**

Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.

#### 5-8 Benchmarks

- applying skills in analysis, synthesis, evaluation, and explanation to their writing and speaking;
- writing and speaking in the content areas, using the technical vocabulary of the subject accurately

#### **Music Standard**

Standard 4: Students will listen to, analyze, evaluate, and describe music.

#### 5-8 Benchmarks

- identifying and examining criteria for evaluating music performances and compositions.

#### **Lesson Overview**

1. Students construct an altitude measuring device.
2. Students launch a rocket and measure the altitude.
3. Following the launch, students communicate logical conclusions based on evidence.

#### **Learning Objectives**

1. Students construct and use an altitude measuring device
2. Students construct a display of data
3. Students measure the altitude of a moving rocket

#### **Before**

1. Students read *Rocket Boys*.
2. Students assemble a rocket from a kit like Estes© [www.estesrockets.com](http://www.estesrockets.com) or Apogee© [www.apogeerockets.com](http://www.apogeerockets.com). Assembly may take 1-3 class periods.
3. Teacher has prepared the launch site; see the websites above for instructions.
4. Mark a spot for students to stand to take the altitude reading, measure the distance from the launch site to the mark for the baseline.
5. **Preview vocabulary**

- **apogee:** the farthest distance an object is or can be. Say: *When we launch your rockets the highest point they reach in the sky is their apogee.* Draw the parabolic curve of a rocket's flight path on the board and indicate that the apogee is at the top of the curve.
- **altitude:** the height of an object above a surface; Say: *Here in Colorado Springs we often talk about our altitude in relation to sea level; Pikes Peak's altitude is 14,110 feet above sea level. Today we are going to measure your rockets altitude at its apogee in relation to the launch-pad.*

## 6. Gather materials

- Student science logs
- Large diameter drinking straw – one per student
- String – 20 cm per student
- Protractor – one per student
- Clear tape
- Weight – large pink eraser works well – one per student
- Calculator with trigonometric functions, tangent, or “tan” key
- Make one copy per student of the Student Lab Sheet “Measuring Altitude.”
- Music Activity: Evaluate Space Film’s Soundtracks
- Select several samples of music (make sure to adhere to copyright laws) from space-themed movies. Show clips from the movies and ask students to evaluate whether the music adds to or detracts from the emotion of the storyline. (Ex: Does the theme for Darth Vader make him seem more ominous?)

## During

1. Say: *The Rocket Boys wanted to measure how high each of their rockets flew and devised a system for measuring the altitude.*
2. Say: *We will measure the altitude of our rockets at their apogee. First we will build an altitude measuring device and use it to measure the height of the flagpole. Then we will launch your rocket and measure its apogee.*
3. Give each student a lab sheet and direct them to the supplies to construct their altitude measuring devices.
4. Assist students measuring the altitude of the flagpole.
5. Help students make calculations for their rocket altitude.

## After

Students write their results and conclusions and submit their work for evaluation.

## Differentiation

Advanced students can find altitude for a greater number of objects, or they can be peer assistants for students who are struggling. Struggling students can work with an assistant.

## ELL Feature

The use of manipulatives is an ELL strategy—students internalize the objectives when they physically measure the angle.

## Other Space Titles

*George's Secret Key to the Universe* by Lucy and Stephen Hawking

Publisher: Simon and Schuster Children's Publishing ISBN-13: 9780743571616

Young readers will enjoy this story co-written by Stephen Hawking and his daughter, Lucy Hawking.

## Space Websites

Free falling objects: This link to a NASA sponsored web page will explain mathematically how the Rocket boys were able to calculate the altitude of their rockets using time as their data.

<http://www.grc.nasa.gov/WWW/K-12/airplane/mofall.html>

Name: \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## Measuring Altitude

Objective: Students will construct and use an altitude measuring device.

Materials:

Drinking Straw

20 cm string

Protractor

Tape

Large eraser

Calculator

Procedure for construction:

1. Tape the straight edge of the protractor to the straw.
2. Attach one end of the string through the center of the protractor and to the straw, don't squeeze the straw shut when tying the string
3. Attach the eraser to the other end of the string to act as a weight.

Procedure for use:

1. Hold the device so that the straw is on top and the protractor is on the bottom.
2. The string should be able to swing freely; if the straw is tilted skyward the eraser will move toward you. If you hold the straw perfectly level the string should hang at the  $90^\circ$  mark on the protractor.
3. Stand at the mark made by your teacher and look through the straw and find the top of the object you would like to measure.
4. Record the **baseline** (distance from the object you are measuring to where you are standing)
5. Use your finger to hold the string against the protractor. Record this number' it is known as the **mark number**.
6. To find the **angular distance**, subtract the number you measured from 90.
7. Use a calculator to find the **tangent of the angular distance** and record.
8. To find the **altitude** of the object multiply the tangent of the angle by the baseline

Data collection:

1. Construct a data table to record the following information for data from measuring the flagpole and the rocket launch: mark number, angular distance, tangent of the angular distance, baseline, and altitude.
2. Teacher must approve your data table prior to collecting data.

Results: State the results of your rocket launch

Conclusion: Discuss why you think you obtained those results

# All Pikes Peak Reads

## 6-8 Math and Science

### Lesson 3: Film Canister Rockets

Texts: *Rocket Boys* by Homer H. Hickam Jr.  
*The Space Tourists Handbook* by Eric Anderson and Joshua Piven

#### **Math standard**

Standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

#### 5-8 Benchmarks

- 1. read and construct displays of data using appropriate techniques (*for example, line graphs, circle graphs, scatter plots, box plots, stem-and-leaf plots*) and appropriate technology;
- 2. display and use measures of central tendency, such as mean, median, and mode, and measures of variability, such as range and quartiles
- 4. formulate hypotheses, draw conclusions, and make convincing arguments based on data

#### **Science standard**

Standard 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

#### 6-8 Benchmarks

- ask questions and state hypotheses that lead to different types of scientific investigations (for example: experimentation, collecting specimens, constructing models, researching scientific literature)
- use appropriate tools, technologies and metric measurements to gather and organize data and report results
- interpret and evaluate data in order to formulate logical conclusions
- 6. communicate results of their investigations in appropriate ways (for example: written reports, graphic displays, oral presentations)

#### **Writing Standard**

Standard 2: Students write and speak for a variety of purposes and audiences.

#### 5-8 Benchmarks

- applying skills in analysis, synthesis, evaluation, and explanation to their writing and speaking;
- writing and speaking in the content areas, using the technical vocabulary of the subject accurately

#### **Art Standard**

Standard 3: Students know and apply visual arts materials, tools, techniques, and processes.

#### 5-8 Benchmarks

- identifying and experimenting with materials, tools, techniques, and processes;

#### **Lesson Overview**

1. Students conduct a simple experiment using a stopwatch to find out if the time it takes a film canister rocket to launch varies with water temperature.
2. Students conduct three trials at each temperature and calculate the average for each temperature
3. Students construct a line graph to analyze data
4. Following the launch, students communicate logical conclusions based on evidence.

#### **Learning Objectives**

1. Conduct a simple experiment and make systematic observations
2. Use a stopwatch to record time data
3. Average the data from four trials
4. Communicate logical conclusions

## **Before**

1. Students read (or listened to) *Rocket Boys*. Say: The Rocket Boys had to experiment with their rocket fuel, make observations and record data; today you will be doing the same process with our film canister rockets!
2. **Preview vocabulary**  
rocket: any of various devices, typically cylindrical, containing liquid or solid propellants which when ignited produce hot gases or ions that escape through a rear vent and drive the container forward (source: yourdictionary.com). Examples of rockets include fireworks, signals, projectile weapons, and spacecraft. *The Space Tourists Handbook* discusses types of rockets (p. 98 and 99).  
independent variable: also known as the manipulated variable; the variable that the scientist controls (in this lab it is water temperature).  
dependent variable: also known as the responding variable; the variable that is measured as a result of changing the independent variable (in this lab it is launch time).
3. **Gather materials**
  - o Student science logs
  - o Film canisters – translucent type where the lid snaps inside the canister
  - o Stopwatches – one for each group; may be helpful to have a back-up timer in each group
  - o Styrofoam plates – for launch pads
  - o Large garbage bags – to put under launch pads for easy clean-up
  - o Halved Antacid tablets – effervescent kind – 8 halves per group
  - o Ice water – one easy to pour from container per group
  - o Room Temperature Water – one easy to pour from container per group
  - o Hot water – one easy to pour from container per group
4. **Make one copy for each student of the attached Student Lab Sheet.**
5. Visual Art Activity: Create a Mission Patch  
Mission patches can be viewed at [www.nasa.gov](http://www.nasa.gov); in the search box for that website, use 'mission patch'. The Apollo 11 and the Challenger patches can be found there. Common components of a mission patch include: (a) an image that can summarize the mission (Ex: a school mascot); (b) names of the "astronauts"; (c) an image of the travel vehicle

## **During**

1. Say: *Today we are going to make and launch rockets! We will make our rockets out of these film canisters using water and antacid tablets for our rocket fuel. We are going to use water that is ice cold, room temperature, and hot to find out which temperature of water makes the rocket launch faster.*
2. Place a halved antacid tablet into a clear cup of water to show students how it bubbles.
3. Have students take out their science logs and write responses to the following statements. *Do you think the temperature of the water will change the amount of time it takes the rocket to launch and why? If yes, which temperature do you think will launch the fastest?*
4. Give each student a copy of the Student Lab Sheet and stress that they must follow directions closely to stay safe. Preview the directions and perform a demonstration.
  - a. Show students how to snap the lid tightly onto the canister Have students practice.
  - b. Tell students that they will place the canister on the ground upside down (lid down).
  - c. Show students that they will fill the canister about 1/3 full with water
  - d. Show them to then place half of an antacid tablet in the canister, snap the lid on quickly and place it upside down on the launch plate (Styrofoam plate)
  - e. Show them they will move about 2 meters away from the launch pads to watch the launch. (Launch takes about 10 seconds, but students should move away quickly.)

- f. The time keeper(s) in the group will start the stopwatch when the lid is snapped on and the rocket is on the launch pad.
- g. The time keeper(s) will stop timing when the rocket leaves the launch pad

### **After**

1. Students draw logical conclusions and make convincing argument based on evidence regarding how the temperature of the water affected the launch time.
2. Students communicate their conclusions in written form using evidence from their investigation to justify their position.
3. Students turn in their line graphs for a grade or can present the graph to the class.

### **Differentiation**

Advanced students can write an investigation procedure for the experiment they suggest at the end of the lab sheet. Provide struggling students with a sentence frame to get them started on their hypothesis: "If the temperature is \_\_\_\_\_[higher], then the rocket launch will happen \_\_\_\_\_[faster]."

### **ELL Feature**

Have ELL students orally present their graphs to you individually so they can practice the new vocabulary in a non-threatening atmosphere.

### **Other Space Titles**

*From the Earth to the Moon* by Jules Verne

ISBN-13: 9781605978850

Publisher: Standard Publications, Incorporated

This classic novel by Jules Verne follows a post-Civil War group of men as they build a gun big enough to facilitate travel to the moon.

*Rockets* by Steven Otfinoski

ISBN-13: 9780761422327

Publisher: Marshall Cavendish Inc

This volume of the Great Inventions series explores the history of rockets and includes diagrams of rockets. This is an excellent reference tool to be added to any middle school library.

### **Space Websites**

Space Rocket Guide: Students and teachers will be able to learn about rockets from different countries and times in history. This website links to several other space websites including histories of many aspects of space exploration and links to military space and space businesses.

<http://www.aerospaceguide.net/spacerocket/index.html>

# Film Canister Rocket Lab

## Student Lab Sheet

**Inquiry question:** How does water temperature affect the amount of time it takes a film canister rocket to launch?

**Materials:** Thermometer; Transparent film canister; 9 halves of antacid tablets; Water: hot, cold, and room temperature; Stop-watch.

**Hypothesis:** In your science log, write an 'If...then...' statement predicting the outcome of the experiment.

**Data Table:** In your science log, construct a data table to record the launch time for three trials at each of the three temperatures; also include room in the table to calculate the average launch time for each temperature.

### Procedure

1. Have the teacher approve your hypothesis and data table before you receive lab materials.
2. Using a beaker, obtain about 100 mL of ice water. Record the temperature of the ice water in your science journal.
3. Fill the film canister approximately 1/3 full with ice water, place a halved tablet in the canister, snap the lid in, START THE STOPWATCH, and place the canister lid-side-down on the launch pad.
4. Stop the stopwatch as soon as the rocket leaves the launch pad.
5. Record the launch time in your data table.
6. Repeat steps 2-5 for the remaining two ice water trials, three room temperature trials, and three hot water trials.

### Analysis

In your science log, construct a line graph of the water temperature vs. the average launch time (one graph with 3 points plotted on it). The teacher must approve the following information before you begin plotting your data. Be sure to include all necessary components (title, scale, etc.) of a graph before you turn in your finished product.

Independent variable \_\_\_\_\_ Dependent variable \_\_\_\_\_

Title for x-axis \_\_\_\_\_ Label for x-axis \_\_\_\_\_

Title for y-axis \_\_\_\_\_ Label for y-axis \_\_\_\_\_

### Results

In your learning log, use complete sentences to state your results.

### Conclusion

In your learning log, write a sentence showing your inference about why you obtained these results. Be sure to include discussion of possible errors (human, equipment, etc.).

### New question

As a result of this laboratory, what is another question you could investigate?