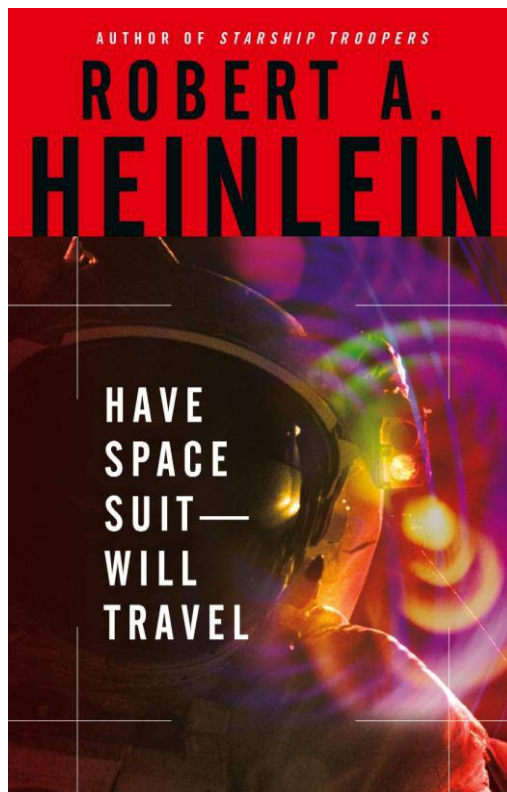


# ***World Space Week Heinlein Teacher Guide***

Science and Language Arts Activities Based on  
Have Space Suit – Will Travel by Robert A. Heinlein

For Use in Grades 5-9 During World Space Week, October 4-10



World Space Week



Heinlein Prize Trust



Heinlein Prize Trust

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

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## ACKNOWLEDGEMENTS



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World Space Week was declared by the United Nations as October 4-10 annually. The largest annual public space event on Earth, World Space Week is celebrated in some 50 countries. It is the ideal time for teachers to use the excitement of space to inspire students to learn.

The Robert A. and Virginia Heinlein Prize Trust offers the Heinlein Prize. The Prize honors the memory of Robert A. Heinlein, a renowned American author. Both Robert and his wife Virginia were strong advocates of human advancement into space through commercial endeavors. The purpose of the Heinlein Prize is to encourage and reward progress in commercial space activities that advances their dream of humanity's future in space. For more information, see [www.heinleinprize.com](http://www.heinleinprize.com).

World Space Week Association, a non-profit organization, supports the United Nations in the global coordination of World Space Week. Founded in 1981, the Association helps the UN expand World Space Week and serve participants. The Association does not advocate any space programs or policies, but encourages worldwide participation in World Space Week. It is led by volunteer Directors and Officers from around the world and is supported by voluntary contributions. For more information, please see [www.worldspaceweek.org](http://www.worldspaceweek.org).

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**TEACHER FEEDBACK FORM**

Please tell us what you did during World Space Week and provide feedback by November 1. You can complete this form on-line at [www.worldspaceweek.org/feedback.html](http://www.worldspaceweek.org/feedback.html) or mail/fax this paper form to WSWA, 957 NASA Parkway, Suite 350, Houston, TX 770058, USA; fax +1 713.481.8846. You can also e-mail comments to [admin@worldspaceweek.org](mailto:admin@worldspaceweek.org). Thank you.

**1. Teacher Information**

1. Your Name:	2. School:
3. Grade:      Subjects:	4. Address:
5. Telephone:	6. City:
7. Fax:	8. State or Province:
9. E-mail:	10. Zip/Postal Code:      Country:

**2. Please rate the activities that you used. Please indicate the approximate amount of class time spent on each and your assessment of the quality of the lesson.**

<b>Activity</b>	<b>Time Allocated</b>	<b>Quality (1 = Poor, 5 = Excellent)</b>				
Space Suit Design: Electric Circuits		1	2	3	4	5
Earth / Moon System		1	2	3	4	5
Lunar Escape		1	2	3	4	5
Humans on the Moon		1	2	3	4	5
Space Suit Design: Solar System Diversity		1	2	3	4	5
Making Observations		1	2	3	4	5
Imagery		1	2	3	4	5
Descriptive Writing: A Lesson in Revision		1	2	3	4	5
Tone / Mood		1	2	3	4	5
The Journey of a Hero: A Discussion		1	2	3	4	5
Conflict		1	2	3	4	5
Compare and Contrast		1	2	3	4	5

**3. How many students participated in total?**



**LESSON SYNOPSIS****Science Activities****Space Suit Design: Electric Circuits**

Students are introduced to series and parallel circuits in a problem based activity.

**Earth / Moon System**

Students construct a simple scale model of the Earth, Moon and other Solar System objects that is accurate for size and distance.

**Lunar Escape!**

Students are introduced to the concept of gravity and plan an escape from Wormface.

**Humans on the Moon**

Students investigate NASA's Apollo program.

**Space Suit Design: Solar System Diversity**

Students design space suits for survival on different Solar System objects.

**Making Observations**

Students explore how we use multiple senses while making observations.

**Language Arts Activities****Imagery**

Students use the text excerpt to identify the author's use of imagery.

**Descriptive Writing: A Lesson in Revision**

Students create a monster and then write a description of it. Students exchange descriptions and attempt to draw the monster. Students then revise their original description.

**Tone / Mood**

Students use a text passage to explore the concepts of tone and mood. Students then write a passage to convey a specific tone or mood.

**The Journey of a Hero: A Discussion**

Students reflect on the entire novel to determine if the main character, Kip, fits the role of a classic hero.

**Conflict**

Students explore the concept of literary conflict.

**Compare and Contrast**

Students compare and contrast two aliens using a text excerpt.

## Science Lesson 1: Space Suit Design: Electric Circuits

**NOVEL EXCERPT:** Pg 27 (Suited up...) to pg. 29 (...automatic changer always worked.)

**BACKGROUND INFORMATION:** In this excerpt, Kip Russell is restoring the electronics in a used spacesuit. It is important that the spacesuit's circuitry has backups, or redundancy, so that the suit will still protect the astronaut if the main system fails. In this lesson, students will use parallel and series circuits to build redundant circuits. No prior knowledge of electric circuits is required.

**LESSON LENGTH:** 50 minutes

**ACKNOWLEDGEMENT:** This activity is based off of the activity, Space Shuttle Safety: Redundant Systems by Space Education Initiatives.

### OBJECTIVES:

The student will be able to

- Construct a circuit to light a bulb
- Identify and describe a series circuit
- Identify and describe a parallel circuit
- Use symbols to construct circuit diagrams

### MATERIAL:

Each group of students will need the following:

- Battery holder and battery
- Socket
- Light bulb
- Wires (at least 10)
- Switches (at least 4)

### PROCEDURE:

1. **INTRODUCTION:** Introduce the reading excerpt by explaining the book, which was written in the 1950's and takes place in the future. Humans have colonized the Moon and spaceflight is common, but expensive. Kip Russell, a high school student, desperately wants to go to the Moon and has won a spacesuit. This excerpt describes his efforts to restore and test his used spacesuit. After the students have read the excerpt, discuss what students think a "fail-safe" system is and why it is important during space travel. Explain that students will design fail-safe circuits with a variety of purposes.
2. **A SIMPLE CIRCUIT:** Divide the class into groups of 2-3 students and provide them with the materials. Students will build a simple circuit consisting of a bulb, battery and switch. They will also sketch the diagram. Have the groups share their diagrams with the class. At this point, do not expect them to draw formal circuit diagrams. This will be introduced in a later step. Explain to students that this circuit is not "fail-safe." If the switch fails "open" you can not turn on the light. If the switch fails in the "closed" position you can not turn the light off.
3. **SERIES CIRCUIT:** In this step, students will build a fail-safe circuit that will allow them to turn a bulb on and off if one of the switches fails in the closed position. Students should draw their circuit. You can test their circuit by telling them which switch has failed and then determining if they can still operate the bulb.
4. **PARALLEL CIRCUIT:** In this step, students will build a fail-safe circuit that will allow them to turn a bulb on and off if one of the switches fails in the open position. Students should draw their



circuit. You can test their circuit by telling them which switch has failed and then determining if they can still operate the bulb.

5. **SHARING CIRCUITS:** Student groups should share their circuit diagrams. How are the circuits similar? How are they different? Students should see the need for consistency in how they draw their circuits. Show them how to draw circuit diagrams and have them redraw their circuits from steps 3 and 4. Discuss with students how electricity flows through circuits. The direction of current is usually shown as + to -. This is called conventional flow and is used by many electricians and engineers. This is NOT the same as the direction of charge carrier (electron) flow that is from - to +.
6. **COMPLEX CIRCUIT:** In this step, students will build a fail-safe circuit that will allow them to turn a bulb on and off if any single switch fails either open or closed. Students should draw their circuit. Test their circuit by picking a switch to fail (open and closed) and then determining if they can still operate the bulb.

**FOLLOW UP ACTIVITIES:**

This activity can be followed up with activities on current, voltage and resistance.

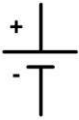


**ENRICHMENT/EXTENSION:**

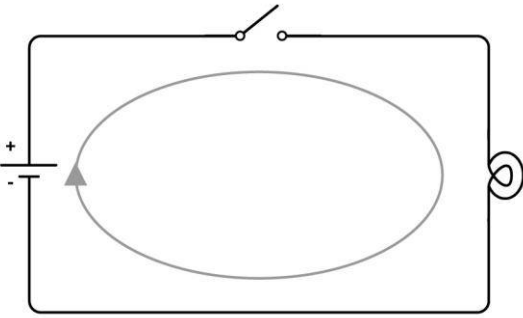
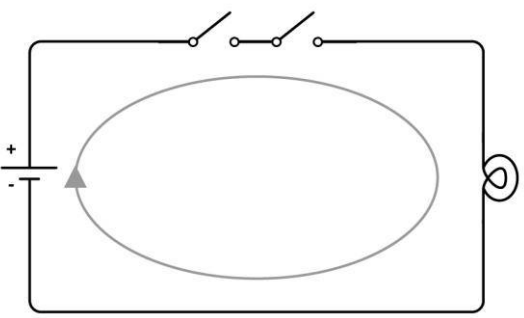
The excerpt used for this activity could be used for additional activities including:

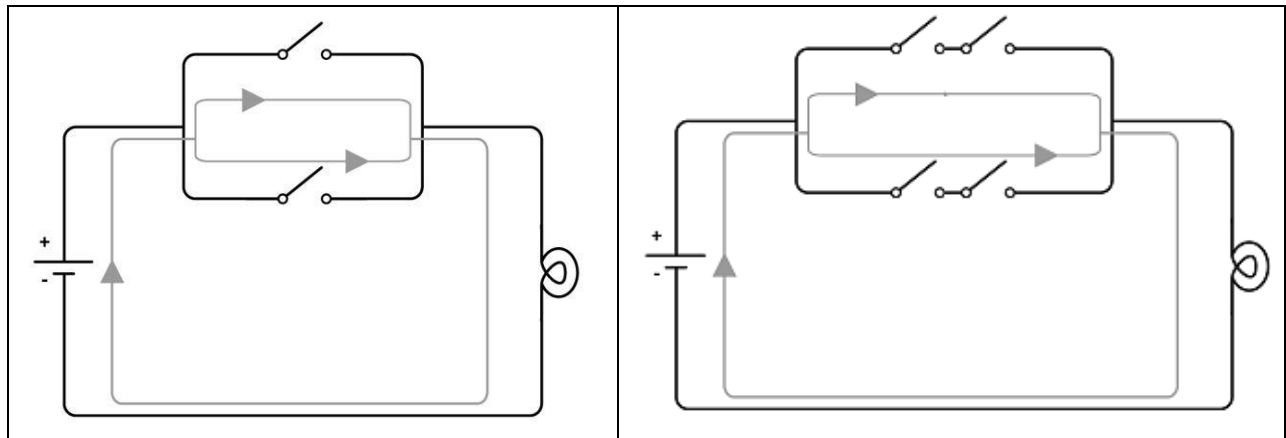
1. Constructing a simple radio from a kit.
2. The activity, Receiving Radio Signals, from NASA's Cassini Mission.

**POSSIBLE ANSWERS:**

Step 5 Circuit Diagram Symbols

		
Battery	Switch (open)	Lamp

<p>Step 2 Circuit Diagram</p> 	<p>Step 3 Circuit Diagram</p> 
Step 4 Circuit Diagram	Step 6 Circuit Diagram



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**SPACESUIT DESIGN: STUDENT HAND-OUT**

In this activity, you will be designing a control system to turn a light bulb on and off. Although this is not as complicated as the circuits in a spacesuit, the scientific concepts are the same.

**Step One: A Basic Circuit**

Your first task is to build a circuit using wires, a battery, socket and light bulb so that you can turn the light on and off. Draw a sketch of your circuit.

A circuit is a closed loop of conductors (usually wires) that allow an electric current to flow. On your sketch, use arrows to show how you think current flows in your circuit.

**Step Two: Single Fault Closed**

In this step we will add to your circuit. Imagine that the single switch in your circuit failed so that it was stuck in the closed (on) position. Would you be able to turn your light off? If it is really important that you can turn the light off, you should add some redundancy to make it “fail-safe.” Add a switch to your circuit so that you can still turn the light on and off even if one of the two switches is stuck in the closed position. This is a single fault closed redundant system. Sketch the circuit. Include arrows to show how you think current flows in your circuit.

**Step Three: Single Fault Open**

Rebuild the circuit that you started with in step one. Now imagine that the single switch in your circuit failed so that it was stuck in the open (off) position. Would you be able to turn the light on? If it is really important that you can still turn the light on, you should add some redundancy. Add a switch to your circuit so that you can still turn the light on and off even if one of the two switches is stuck in the open position. This is a single fault open redundant system. Sketch the circuit. Include arrows to show how you think current flows in your circuit.

**Step Four: Circuit Diagrams**

Compare your drawings for each of your circuits with those of the rest of your class. Are they all the same? Since each diagram uses different symbols to represent the objects in the circuit, it may be difficult to tell what is going on. So that engineers can read each others diagrams, they all use a common set of symbols when they make their diagrams. Your teacher will show you examples of symbols that you should use when making a circuit diagram. Sketch proper circuit diagrams for each of your double circuits. Include arrows (as described by your teacher) in your diagram to show how current flows.

**Step Five: Single Fault Open/Closed**

Let's say that your life depends on being able to turn this light on AND off. Build a system that is redundant for both on and off. This means that if any switch fails open or closed you can still turn the light on and off. Build the circuit and have your teacher test it. Then sketch the circuit diagram. Include arrows in your diagram to show how the current flows.

## Science Lesson 2: Earth / Moon System

**NOVEL EXCERPT:** Page 41 (paragraph starts with Peewee saying, "But right now I think we better hang on...") to page 42, about 1/2 way down... (Kip says, "...And why were you stealing a ship?")

**BACKGROUND INFORMATION:** In this excerpt, Kip and Peewee have been kidnapped and are being taken to the Moon. The spacecraft is about to undergo a "spin-flip" maneuver. The spacecraft in this book travel at a constant acceleration (1g is the acceleration due to gravity on Earth's surface or 9.8 m/s/s) for one half of the trip. Then, in a very short amount of time, the spacecraft reverses its acceleration and slows at a constant acceleration for the second half of the trip. In this lesson, students will build a scale model of the Earth / Moon system. Students may also perform average velocity calculations and conduct additional research.

**LESSON LENGTH:** 20 minutes (50+ minutes with student research)

**ACKNOWLEDGEMENT:** This activity is based off of the activity, Scale Models of the Solar System by Space Education Initiatives.

### OBJECTIVES:

The student will be able to

- Describe the relative sizes of the Earth and Moon
- Visualize the distance between the Earth and Moon

### MATERIAL:

Each pair of students will need the following:

- 50 ft of string
- 2 blue balloons
- 1 ping pong (or golf) ball

### PROCEDURE:

1. **INTRODUCTION:** Introduce the reading excerpt by explaining the book, which was written in the 1950's and takes place in the future. Humans have colonized the Moon and spaceflight is common, but expensive. Kip Russel, a high school student, desperately wants to go to the Moon and has won a spacesuit. In the process of restoring his used spacesuit, he gets captured by an alien "space pirate" and is being transported, along with another human named Peewee, to the alien's Lunar hideout. Students should read the excerpt.
2. **PREDICTIONS:** Provide each pair of students with the materials. Instruct students to build a scale model, based on their best guesses, for the Earth / Moon system. Students should use the ping pong ball as the Moon, blow the balloon up to what they think is the appropriate size of the Earth and place them as far apart as they think they should be.
3. **SCALE MODEL:** Explain to students that the circumference of the Earth is 4 times the circumference of the Moon. Students should use string to measure this and then blow up the second balloon to the correct size. The Moon is approximately 10 "Earth circumferences" from the Earth. Students can measure this by wrapping string around the Earth-balloon 10 times. Students should place the Earth and Moon at the appropriate distances.
4. **DISCUSSION:** Ask students where the International Space Station is located (only 240 miles from the surface, about the thickness of the tip of your pinky finger). Introduce the Apollo missions and explain that it took astronauts 3-4 days to travel to the Moon. Humans have not been to the Moon since December of 1972. In the book excerpt, the spacecraft was able to make

it to the Moon in about 3 hours. Use a student model to show how the “spin-flip” maneuver works. This is not currently possible with human spaceflight.

**FOLLOW UP ACTIVITIES:**

This activity can be followed up with these activities:

1. **CALCULATIONS:** Have students research the length of time that a specific Apollo mission took to get to the Moon. Have students calculate the average velocity of the Apollo spacecraft. Have students calculate the average velocity of the spacecraft in the book (Velocity = distance / time).
2. **RESEARCH:** Have students conduct research on the Apollo Lunar Landing missions. Student groups can create a poster for each landing mission.

**ENRICHMENT/EXTENSION:**

This activity can be extended by having students determine the sizes and distances for the Sun and planets based on the scale used in this activity.

**POSSIBLE ANSWERS:**

Size / Distance for selected objects

Object	Circumference (miles)	Circumference (Compared to Earth)	Average Distance to Earth (miles)	Average Distance to Earth (compared to Earth's circumference)
Earth	25,000	1	0	0
Moon	6,800	~1/4	240,000	~10
Mars	13,240	~1/2	48 million	~2000
Jupiter	279,000	~11	390 Million	~15,500
Sun	2,700,000	~108	93 Million	~3,700
Pluto	4500	~5/28	3570 Million	~140,000
Proxima Centauri	NA	NA	25 Trillion	~1,000,000,000

## Science Lesson 3: Lunar Escape!

**NOVEL EXCERPT:** Excerpt 1: Pg 52 (all) to pg 54 (...That's what I'll do.)

**BACKGROUND INFORMATION:** In this excerpt, Kip and Peewee have landed on the Moon. The excerpt describes Kip's initial experiences in the lowered gravitational field on the Moon. In this activity, students will plan for an escape, view videos of astronauts on the Moon and explore lunar gravity.

**LESSON LENGTH:** 50 minutes

**OBJECTIVES:**

The student will be able to

- Explain that the Moon does have gravity because it has mass
- Explain how the reduced gravity on the Moon might affect human activity

**MATERIAL:**

Each group will need the following:

- Tape measure or ruler
- Computer with Internet access, or one computer with a projection device

**PROCEDURE:**

1. **INTRODUCTION:** Introduce the reading excerpt by explaining the book, which was written in the 1950's and takes place in the future. Humans have colonized the Moon and spaceflight is common, but expensive. Kip Russel, a high school student, has been kidnapped by "Space Pirates" and has met up with Peewee and the Mother Thing, fellow captives of Wormface. In these excerpts, the captives have just landed on the Moon. Before having students read the first excerpt, have them answer this question, "Is there gravity on the Moon?" Why or why not?
2. **REDUCED GRAVITY:** Students should view the video clips and explain why this is evidence that there is gravity on the Moon. Students should complete the Lunar Broad Jump activity and the questions in the handout. **NOTE:** Since Lunar gravity is  $1/6^{\text{th}}$  that of the Earth, you would be able to jump 6 times as far. The videos can be found at: <http://www.worldspaceweek.org/heinlein.html>
3. **ESCAPE:** Explain to students that shortly after the excerpt that they read, Kip and Peewee were able to escape from Wormface's ship and began a daring hike towards the Lunar colony, Tombaugh station. Students should complete the "Crash Landing" activity. After the class shares their list of most important survival equipment, have students write a one page story about Kip and Peewee's escape. The story should incorporate the equipment that they chose and their knowledge about the Moon's reduced gravity. The Crash Landing activity can be found at: <http://www.astrosociety.org/education/family/materials/crashlanding.pdf>

**FOLLOW UP ACTIVITIES:**

Students can calculate their weight on other planets at:

<http://www.exploratorium.edu/ronh/weight/index.html>

## LUNAR ESCAPE!: STUDENT HAND-OUT

1. Watch the two videos of astronauts working on the surface of the Moon. The videos are located at <http://www.worldspaceweek.org/heinlein.html>.

If there was no gravity on the Moon, how would these video clips be different?

**What's Going On?**

Gravity is a force that acts between any two objects that have mass. The force of gravity acts to pull the objects together. For example, the force of gravity between you and the Earth pulls you back to the surface when you try and jump. The force of gravity between the Moon and an astronaut keeps them from flying off into space when they hop.

However, if you were on the Moon, the force of gravity acting on you would be less than when you are on the Earth because the Moon has less mass. In fact, the force of gravity on the Moon is 1/6th of what it is on the Earth. This means that you could jump, or throw a ball 6 times farther on the Moon than you can on the Earth!

2. Work with a partner to determine how far you can jump from a standing position on Earth. How far could you jump on the Moon?
  
3. What is your favorite sport or physical activity? Describe how this activity would be different on the Moon compared to the Earth.

NOTE: Many times, people confuse the term mass and weight. Mass is the amount of stuff that makes you up. Weight is a measurement of the force of gravity acting on you. So, if you weighed 90 pounds on Earth, you would only weigh 15 pounds on the Moon. The force of gravity on Mars is only 1/3 of what it is on the Earth, so a 90 pound person would only weigh 30 pounds on Mars. But, whether you are on the Moon, Mars, or the Earth, you still would have the exact same mass.

## Science Lesson 4: Humans on the Moon

**NOVEL EXCERPT:** Pg 89 (I had wondered) to pg 91 (...battery.)

**BACKGROUND INFORMATION:** In this excerpts, Kip, Peewee, and the Mother Thing have escaped from Wormface's ship and are hiking towards Tombaugh Station, a lunar colony. In this activity, students will research the Apollo program.

**LESSON LENGTH:** Two - 50 minute sessions

**OBJECTIVES:**

The student will be able to

- Describe the Apollo Lunar landing missions

**MATERIAL:**

No special materials are needed for this activity. Internet access is needed for the research portion of the activity.

**PROCEDURE:**

1. **INTRODUCTION:** Introduce the reading excerpt by explaining the book, which was written in the 1950's and takes place in the future. Humans have colonized the Moon and spaceflight is common, but expensive. Kip Russel, a high school student, has been kidnapped by "Space Pirates" and has been transported to their base on the Moon. In the excerpt, Kip and his fellow captives are making a desperate escape and get their first glimpse of Tombaugh Station, a Lunar colony and safe haven. After the students read the excerpt, explain to them that between 1969 and 1972, 12 humans visited, explored and lived on the Moon as part of NASA's Apollo program. Humans have not set foot on the Moon since.
2. **PREPARATION:** Divide the class into 11 groups. Assign each group an Apollo mission (Apollo 7 – 17). Students should create a poster that describes the crew, objectives and significance of their mission. Students that have Lunar landing missions should also identify the landing site on the Moon map.
3. **SHARING:** Student groups should share their mission posters. Display the posters. String can be used to connect posters for Apollo 11, 12, 14-17 to their landing sites on the moon map.

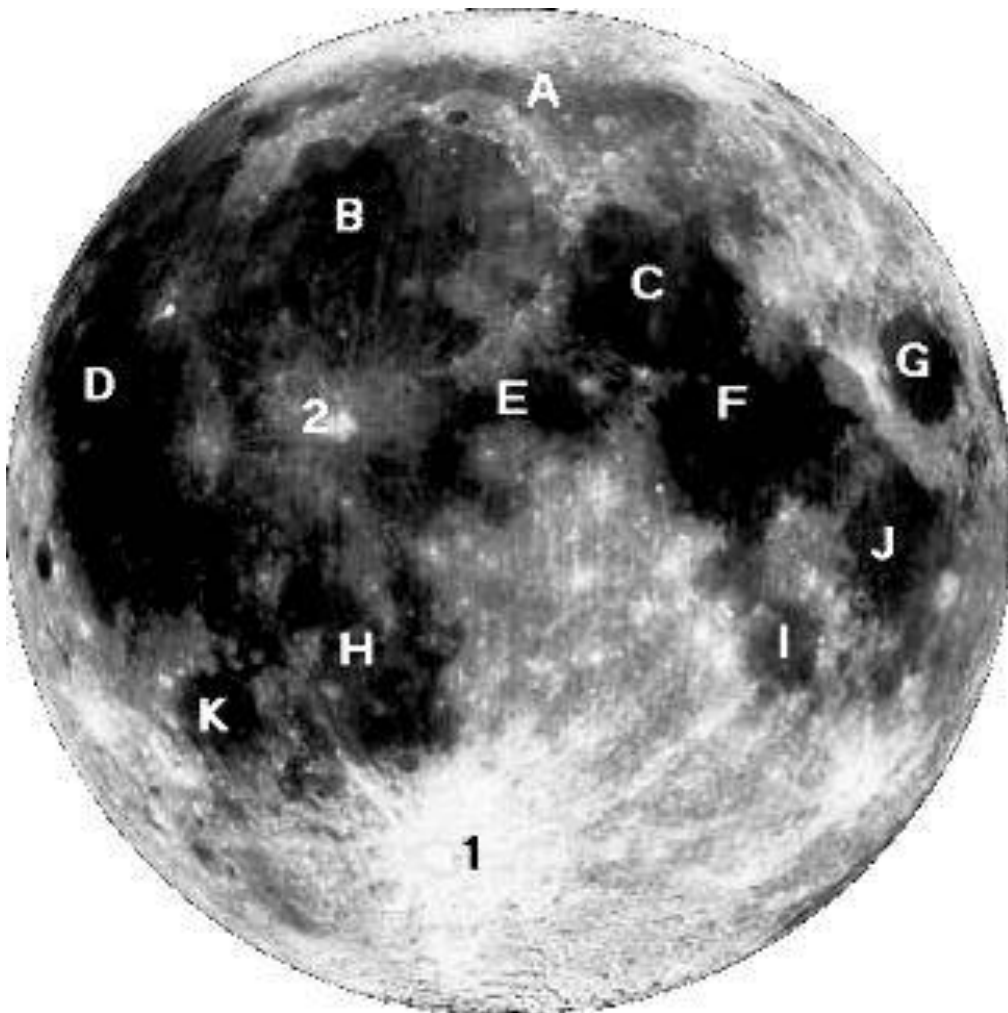
**FOLLOW UP ACTIVITIES:**

This activity can be followed up with these activities:

1. Students could write an essay about what it would be like to live in the fictional Tombaugh Station.
1. Have students observe and sketch the Moon. They should label any of the features that they can discern.
2. The Moon map on the next page can be used during Step 3 and for student observations.



Observing the Moon



Location	Name
A	Mare Frigoris (Sea of Cold)
B	Mare Imbrium (Sea of Showers)
C	Mare Serentatis (Sea of Serenity)
D	Oceanus Procellarum (Ocean of Storms)
E	Mare Vaporum (Sea of Vapors)
F	Mare Tranquillitatis (Sea of Tranquility)
G	Mare Crisium (Sea of Crisis)
H	Mare Nubium (Sea of Clouds)
I	Mare Nectaris (Sea of Nectar)
J	Mare Fecunditatis (Sea of Fertility)
K	Mare Humorium (Sea of Moisture)

## Science Lesson 5: Space Suit Design: Solar System Diversity

**NOVEL EXCERPT:** Pg 101 (The outer door opened and I had my first view of Pluto.) to Pg 102 ("Come!" I heard it through my helmet.)

**BACKGROUND INFORMATION:** In this excerpt, Wormface's associates have taken Kip, Pewee, and the Mother Thing to their secret base on Pluto. The excerpt describes Kip's walk on the surface of Pluto from the spacecraft to the base. In this activity, students will work in small groups to research a specific planet. Student groups will select a location on the planet to visit, design a spacesuit for the planet and describe and "outing" at their location.

**LESSON LENGTH:** Three - 50 minute sessions or One - 50 minute session and homework

### OBJECTIVES:

The student will be able to

- Describe examples of the diversity of the Solar System
- Explain the hostile conditions on at least one planet

### MATERIAL:

No special materials are needed for this activity. Internet access is needed for the research portion of the activity.

### PROCEDURE:

1. **INTRODUCTION:** Introduce the reading excerpt by explaining the book, which was written in the 1950's and takes place in the future. Humans have colonized the Moon and spaceflight is common, but expensive. Kip Russel, a high school student, has been kidnapped by "Space Pirates" and has been transported to their base on Pluto.
2. **PREPARATION:** Divide the class into seven groups. Assign a planet (besides the Earth and Pluto) to each group. Instruct students to research their assigned planet and find information about the planet's surface features, temperatures and atmosphere. Students should also select one location on their planet as a destination for an "extreme adventure (For Example: Snowboarding down Pluto's snowy slopes). Students that have been assigned to a Gas Giant should have the option of selecting one of the planet's moons. For their location, students should:
  - a. Create a "fact sheet" for characteristics of the planet.
  - b. Design a spacesuit with specific features that will allow humans to survive on the planet. Students should draw an illustration and write a description of the spacesuit.
  - c. Write a 1-2 page narrative of an extreme adventure on their planet.
3. **SHARING:** Student groups should share their illustration and description of their spacesuit with the entire class. They should support the features of their spacesuit by describing planetary conditions.

### FOLLOW UP ACTIVITIES:

Students can design "Extreme Adventure" brochures for their assigned planet.

## Science Lesson 6: Making Observations

**NOVEL EXCERPT:** Page 45 (I was face up but... to ... He had no expression in his speech)

**BACKGROUND INFORMATION:** Kip Russell has been skyjacked by a monstrous extraterrestrial. This is the part of the novel where Kip sees Wormface for the first time.

Making accurate observations in science as well as any subject requires the use of at least one of the five senses. The more senses used in the observation the more accurate the description. This allows the reader to have a very detailed visual image of what is being described. When observations are made using all of the five senses, the reader not only gets a complete visual image, but the figure becomes more alive and real. This is important because it can give one clues to the importance of the scene depicted or the character being discussed. One of the shortcuts people often take in their writing is to describe something using only one sense.

### PROCEDURE:

#### Part One:

1. Read the poem, *The Blind Men and the Elephant*. It can be found at this site: <http://www.peacecorps.gov/wws/guides/looking/story22.html>
2. Discuss the questions on the worksheet. You may want to have the students do this on their own, in a group, or as a class discussion.

#### Part Two:

1. Read the excerpt from the book. Have the students identify the descriptions that use one of the five senses. They should identify which sense is used.
2. Discuss the questions on the worksheet.

#### Part Three:

The students will now write a description of an earthling using as many senses as they can in their description. They will use Wormface's point of view in making the description. They should take into consideration the sense organs that a creature such as Wormface has and how they will use them.

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**MAKING OBSERVATIONS: STUDENT HANDOUT****Part One**

Read the Blind Men and the Elephant at:

<http://www.peacecorps.gov/wws/guides/looking/story22.html>

**The Blind Men and the Elephant**

1. What is the sense that the blind men are using?
2. What were the limitations of using just this sense?
3. Did the blind men get a true picture of the elephant? Explain?
4. Did the reader get a true picture of the elephant from the description the blind men gave?
5. What if you put all the descriptions of the elephant together, would you still get a true picture of what one looked like?
6. What could be done to give the reader a true picture of an elephant?

Part Two:

**Have Space Suit-Will Travel**

1. What senses does the author Robert Heinlein use in describing Wormface?
2. Did the descriptions using the senses add to the reader's ability to visualize Wormface?
3. Do you think the images used gave clues to the character?
4. Could the author have added more descriptions using senses and given you a better idea of Wormface?
5. In the description of the elephant, the reader does not get an idea of the personality of the elephant. How does this differ from the image you get of Wormface?

Part Three:

**Your Turn**

How would you describe an earthling from Wormface's point of view? Remember to use as many senses as you can in writing your descriptions. Think about the organs with which Wormface has to make observations.

## Language Arts Lesson 1: Imagery

**NOVEL EXCERPT:** Page 45 (I was face up but... to ... He had no expression in his speech)

**BACKGROUND INFORMATION:** Kip Russell has been skyjacked by a monstrous extraterrestrial. This is the part of the novel where Kip sees Wormface for the first time.

**LESSON LENGTH:** 1-3 50 minute sessions.

### OBJECTIVES:

The student will be able to

- Identify and recognize imagery and terms associated with imagery
- Locate and discuss examples of imagery in a written passage
- Create their own images in a written passage

**Imagery Terminology:** Language used to create a certain effect, to make the meaning clearer, or to create an image. See the **Student Handout** for examples.

### PROCEDURE:

1. Discuss the terms listed in the **Student Handout** with the students. Go over definitions; look at the examples, and discuss the effect that it creates with the reader.
2. Have the students make up some of their own, being certain not to use cliches.
3. Have the students read the passage and identify images of the passage as well as the type of image that it is. This may be done as a group or individually.
4. Have a class discussion of their findings and how effectively these images are in the readers' minds. How do they help create images or clarify meaning for the reader?

### FOLLOW UP ACTIVITIES:

**This activity can be followed up with these activities:**

1. Have the students draw the image. Then have them share their images, discussing which are factual from the text and which came from their own imaginations. What details are omitted? Is it a good thing or a bad thing to leave room for the readers' imaginations?
2. Have the students write a description of one of their friends using figurative language in their writing.
3. Have the students write a description of one of the characters in the novel.

### ENRICHMENT/EXTENSION:

Proceed to Lesson 2.

### POSSIBLE ANSWERS:

**SIMILE:** "...with feet...which bulged out, almost disc-like."

"His movements were blurringly fast, like a striking snake."

"His arms looked like snakes."

"...the mouth was rimmed with cilia as long as angleworms."

"They scanned like radar,..."

"He pinned me down like a beetle."

**METAPHOR:** "When he stood still a tail, or third leg, extruded....and turned him into a tripod."

**ONOMATOPOEIA:** "...squashy, sucking sounds..."  
"...his dentals had a clucking quality."

**PERSONIFICATION:** "...my skin will crawl..."

**ANALOGY:** "...he dominates us the way a man dominates a horse."

**HYPERBOLE:** "...my skin will crawl..."

**ALLITERATION:** "...squashy, sucking sounds..."

**CLICHES:** These are fresh descriptors.

**DETAILS:** "...he wasn't human..."  
"...built more like a human than an elephant..."  
"...stood erect..."  
"...feet at one end and a head at the other..."  
"...five feet tall..."  
"...short legs did not make him slow..."  
"...they had more joints than ours."  
"He had two sets...in place of money and keys."  
"His skin was purplish brown..."  
"...not the same race as Mother Thing."

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**IMAGERY: STUDENT HANDOUT**

**Imagery**--the collection of images in a literary work through the use of descriptive language to recreate sensory experiences, set a tone, suggest emotions, or guide reader's reactions.

**Sensory Imagery**--images presented in the piece to appeal to one of the reader's five senses: sight, taste, smell, sound and touch.

**EXAMPLE:**

- Her yellow chiffon dress twirled and swirled about her.
- The chocolaty warmth of the doughnut melted in my mouth.
- A foul, smoky odor filled the garage.
- The clawing of her nails across the board made the hair on the back of my neck stand up.
- The rough fingers on his hand raked across my arm.

**STUDENT EXAMPLES:**

**Figurative Language**--writing or speech not meant to be interpreted literally.

**STUDENT EXAMPLES:**

**Simile**--A simile is an indirect comparison between two or more objects using *like* or *as*.

**EXAMPLE:**

- Her dress is as yellow as butter.
- She crawled like a baby on-the-run away from the fire.

**STUDENT EXAMPLES:**

**Metaphor**--A metaphor is a direct comparison between two or more objects.

**EXAMPLE:**

- My mom is being a bear.
- My mom growled as I walked in the door as she scraped her claws across the kitchen counter.

**STUDENT EXAMPLES:**

**Onomatopoeia**--Words that by their sound suggest their meanings.

**EXAMPLE:**

- Buzz
- Hiss
- Whirr
- Sizzle

**STUDENT EXAMPLES:**

**Personification**--A figure that gives animals, ideas, abstractions and inanimate objects human characteristics.

EXAMPLE:

- The light danced across the floor.
- The tree reached for the stars.

STUDENT EXAMPLES:

**Analogy**--A comparison by comparing something unfamiliar to something familiar.

EXAMPLE:

- The children followed the crossing guard just like baby ducks waddling after their mother.

STUDENT EXAMPLES:

**Hyperbole**--Exaggeration to create an effect or for humor.

EXAMPLE:

- She sounded like a hyena.
- Her nose is a Toucan's beak.
- The pain was a knife in my side.

STUDENT EXAMPLES:

**Alliteration**--The use of initial consonant successive consonant sounds to create an effect.

EXAMPLE:

- The long, slithery snake slid into the hole.
- The cat crept clumsily into her crate.

STUDENT EXAMPLES:

**Cliches**--Overused statements which have lost their freshness and effectiveness.

EXAMPLE:

- Her eyes are sparkling like diamonds.
- She's as fat as a hippopotamus.
- He's as tall as a giraffe.

STUDENT EXAMPLES:

**Details**--Giving detailed information to help clarify the images. These are often in the form of adjectives, vivid verbs and specific nouns. Details often clarify by adding details of color, size, shape, time, place, number, amount, actions, etc.

STUDENT EXAMPLES:



## Language Arts Lesson 2: Descriptive Writing: A Lesson in Revision

**LESSON LENGTH:** 2-3 50 minute sessions

**NOVEL EXCERPT:** Page 45 (I was face up but... to ... He had no expression in his speech)

**BACKGROUND INFORMATION:** Kip Russell has been skyjacked by a monstrous extraterrestrial. This is the part of the novel where Kip sees Wormface for the first time.

**OBJECTIVES:**

The student will be able to

- Create a monster similar to Wormface
- Write a descriptive paragraph imitating the passage in the novel
- Identify different revision strategies to employ in the writing process
- Revise his/her own papers using these revision strategies
- Rewrite his/her own paper

**PROCEDURE:**

**Part One:**

1. Have the students read the passage. Tell the students that author's create images in the minds of the reader through his/her diction (word choice).
2. Discuss the images projected through details, sensory imagery, and figurative language.
3. Decide as a class if the author did a good or a poor job (See lesson 1).
4. Have the students draw a monster which they create using only geometric shapes. They must color the monster. **EMPHASIZE THAT THEY SHOULD PREVENT OTHER STUDENTS FROM SEEING THEIR MONSTERS.**
5. Have the students write a description imitating the style of Robert Heinlein using details, sensory imagery and figurative language. Have them name their monsters. Do not let them write his/her own name on this paper.
6. Collect the assignment.

**Part Two:**

1. Give each child another child's descriptive writing. Do not let them see the drawings.
2. From the child's written description, have the student draw the monster described in the paper. Have them include the name of the monster.
3. Collect the papers.
4. Display both the original and the newly-drawn monster. Compare them.
5. Have students give suggestions for improvements in the paper. Have them emphasize what was done well in the writing as well as improvements that are needed (See **STUDENT HANDOUT**).

6. Have the students distinguish between contextual entries as well as what comes from the reader's imagination.
7. Discuss the parts done well in the writing as well as what was omitted and should have been included.
8. Have students give their findings to the author of the paper as well as both drawings.

**FOLLOW UP ACTIVITIES:**

This activity can be followed up with these activities:

1. Have the students revise his/her paper. This is an excellent lesson for revision for students who do not understand the kinds of things they can do for revision.
2. Repeat **PART 2** to see improvements. There is nothing like a picture to see what is missing.

DESCRIPTIVE WRITING: STUDENT HANDOUT

MONSTER'S NAME: \_\_\_\_\_

I really liked

However, you forgot

May I suggest for your next writing that you

## Language Arts Lesson 3: Tone / Mood

**NOVEL EXCERPT:** Page 45 (I was face up but... to ... He had no expression in his speech)

**BACKGROUND INFORMATION:** Kip Russell has been skyjacked by a monstrous extraterrestrial. This is the part of the novel where Kip sees Wormface for the first time.

**LESSON LENGTH:** 1-3 50 minute sessions

**OBJECTIVES:**

The student will be able to

- Identify different mood and tone words
- Locate these words in a passage from the novel
- Discuss the ways the author sets this mood/tone in the passage
- Choose a tone/mood term and create a passage to set that particular tone/mood

**LITERARY TERMS:**

**Mood:** In a literary work the *mood* is the emotional-intellectual attitude of the author toward his subject.

**Tone:** *Tone* has been used as the author's attitude toward his subject as well as toward his audience. It often shows not only how he feels toward his subject, but how he wants his audience to feel toward his subject.

**PROCEDURE:**

1. Discuss the two terms above.
2. Read the passage aloud.
3. Have the students suggest tone/mood words to describe the passage.
4. Discuss how they arrived at their answers.
5. Locate in the passage the clues.
6. From the list of feeling words, have the students choose one of the words (See Feeling Words).
7. Have the students write a passage which sets the tone/mood of the word choice.

**EXTENSION:**

1. Have the students read their pieces aloud to the class.
2. Have the students write the tone/mood word on a piece of paper that they believe the student was trying to portray in his/her paper.
3. If only a few got the correct feeling, discuss why that happened; if nearly everyone guessed the correct answer, then discuss what they did well to establish the tone/mood.
4. It is fun to add words to existing lists and to create new lists.

**Feeling Words****HAPPY**

restive  
contented  
relaxed  
calm  
complacent  
satisfied  
serene  
comfortable  
peaceful  
ecstatic  
enthusiastic  
inspired  
glad  
pleased  
grateful  
cheerful  
excited  
cheery  
lighthearted  
buoyant  
carefree  
surprised  
optimistic  
spirited  
vivacious  
brisk  
sparkling  
merry  
generous  
hilarious  
exhilarated  
jolly  
playful  
elated  
jubilant  
thrilled

**SAD**

sorrowful  
unhappy  
depressed  
melancholy  
gloomy  
somber  
dismal  
heavy-hearted  
quiet  
mournful  
dreadful  
dreary  
flat  
blah  
dull  
in the dumps  
sullen  
moody  
sulky  
out of sorts  
low  
discontented  
discouraged  
disappointed  
concerned  
sympathetic  
compassionate  
choked up  
embarrassed  
shameful  
ashamed  
useless  
worthless  
ill at ease

**ANGRY**

resentful  
irritated  
enraged  
furious  
annoyed  
inflamed  
provoked  
infuriated  
offended  
indignant  
irate  
wrathful  
cross  
sulky  
bitter  
frustrated  
grumpy  
boiling  
fuming  
stubborn  
belligerent  
confused  
awkward  
bewildered

**DOUBTFUL**

unbelieving  
skeptical  
distrustful  
suspicious  
dubious  
uncertain  
questioning  
evasive  
wavering  
hesitant  
perplexed  
indecisive  
hopeless  
powerless  
helpless  
defeated  
pessimistic

**EAGER**

keen  
earnest  
intent  
zealous  
ardent  
avid  
anxious  
enthusiastic  
desirous  
excited  
proud

**HURT**

injured  
isolated  
offended  
distressed  
pained  
suffering  
afflicted  
worried  
aching  
crushed  
heartbroken  
despair  
tortured  
lonely  
pathetic  
cold  
upset

**FEARLESS**

encouraged  
courageous  
confident  
secure  
independent  
reassured  
bold  
brave  
daring  
heroic  
hardy  
determined  
loyal  
proud  
impulsive

**PHYSICAL**

taut  
uptight  
immobilized  
paralyzed  
tense  
stretched  
hollow  
empty  
strong  
weak  
sweaty  
breathless  
nauseated  
sluggish  
weary  
tired  
alive  
feisty

**INTERESTED**

concerned  
fascinated  
engrossed  
intrigued  
absorbed  
excited  
curious  
inquisitive  
inquiring

**AFFECTIONATE**

close  
loving  
sexy  
tender  
seductive  
passionate  
aggressive  
appealing  
warm

**MISCELLANEOUS**

humble  
torn  
mixed-up  
envious  
jealous  
preoccupied  
cruel  
distant  
bored  
hypocritical  
torn  
cooperative  
phony  
two-faced

**AFRAID**

fearful	alarmed	doubtful
frightened	cautious	suspicious
shocked	hesitant	shocked
horrified	awed	insecure
shaky	insecure	dismayed
apprehensive	impatient	scared
fidgety	nervous	cowardly
terrified	dependent	threatened
panicky	anxious	appalled
tragic	pressured	petrified
worried	gutless	hysterical

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## Language Arts Lesson 4: The Journey of the Hero: A Discussion

**NOVEL EXCERPT:** Entire novel

**OBJECTIVES:**

The student will be able to

- View and discuss the characteristics of the journey of the archetypal hero
- Apply the characteristics to a character in the novel
- Analyze and evaluate whether the character is a hero
- Respond in writing to the question

**LESSON LENGTH:** 1 day

**PROCEDURE:**

1. Is Kip Russell an archetypal hero? Have students decide and explain to the class why they believe he is or he isn't.
2. Using the **STUDENT HANDOUT**, discuss each of the characteristics.
3. Then have students write a paragraph agreeing or disagreeing with Kip Russell being a hero. They must support their decisions with an explanation of his/her thinking.
4. You can also have them vote.

**EXTENSION:**

Have the student choose a fairy tale or a Disney story and take the main character through the journey to determine if he/she is an archetypal hero. Then have the student present his/her findings to the class.

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**THE JOURNEY OF A HERO: STUDENT HANDOUT**

Characteristics of a classic hero:

1. The central character is usually naive and callow.
2. He meets monsters and/or monstrous men.
3. She has a strange, wise, being as a mentor.
4. He often yearns for a beautiful lady, who is sometimes his guide or inspiration.
5. She must go on a journey, learn a lesson, change in some way, and return home.
6. He often travels on a body of water or travels on a bridge.
7. She returns to the land of her birth as an unknown or in a disguise.
8. He struggles for something valuable or important.
9. She is usually born and raised in a rural setting away from cities.
10. His origin is mysterious or he loses his parents at a young age, being raised by animals or by a wise guardian.
11. She is somehow special or one-of-a-kind. She may represent a whole nature or a culture.
12. He has help from divine or supernatural forces.
13. She has a guide or guides.
14. He goes through some type of ritual of initiation or a rite of passage.
15. She often has some kind of magical protective device (amulet).
16. He has a loyal band of companions.
17. She often makes an emotional speech to her followers.
18. He engages in tests of strength, mental and/or physical, and shows pride in his excellence.
19. She goes through a rite of passage or an initiation; she changes and matures as the story proceeds.
20. He suffers some kind of wound that is unable to heal. It may be emotional, physical, or spiritual.
21. She must enter a dark, terrible, frightening place; sometimes she descends into the underworld where she learns an important lesson.
22. He wins what he fights for. He is united or re-united with what he cares about.
23. She emerges to right a wrong of a society or people.
24. He behaves to excess; he is larger-than-life.
25. Her task is to raise or transform society.
26. He reminds people of lost or corrupted values.
27. She is prepared to die at any moment.
28. He fights for glory.
29. She sees beyond the vision of the present.
30. He chooses the short and glorious life of the battle or the long life of the maturing journey.
31. Her standards of excellence far exceed the ordinary.
32. He must be tested, and he must suffer.

**FIGHT! FLIGHT! LEARN! RETURN!**



## Language Arts Lesson 5: Conflict

**LESSON LENGTH:** 1 day

**NOVEL REFERENCE:** Entire novel

**BACKGROUND INFORMATION:** Twice in the novel, Kip, Peewee and the Mother Thing have to escape the bad guys. This is not an ordinary escape that we would find on Earth. They are on the moon the first time and Pluto the second. Both of these places require that a person outside of a spaceship not only have oxygen and a specialized protective suit but also to be able to navigate difficult terrain.

Types of Conflict:

1. Human against self-when man has an inner struggle. This is often depicted as the angel vs. the devil inside of you.
2. Human against man-when there is a physical or verbal fight between two people.
3. Human against nature-when man has to struggle with his outside environment. On Earth it would be Mother Nature, in space, Alien environments.
4. Human against society-when man is struggling against the laws of God or something higher or larger than morals, or ethics.
5. Human against the universe-this is when man faces moral struggles. Should I tell a lie, would be an example.
6. Human against supernatural-this is when man faces something that can't be explained (fate, trust, etc.).

**PROCEDURE:**

1. Discuss with the students the different types of conflict. Give them some real world examples of when they see this in movies or novels.
2. Explain to the students that they will be doing a writing assignment that will illustrate the different types of conflict that they find in the novel. They will discuss which ones they find, the outcome and how the conflict drove the outcome.
3. Have students use the prewriting worksheet attached and then do a final draft from it.

**CONFLICT: STUDENT HANDOUT**

Directions: Fill in the following situations that illustrate the different types of conflict you find in the book. Two have been done as examples for you. You can add an extra page if needed.

**Setting:** At school.

**Situation:** Your best friend asks you to spend the night and go to a party with them. Your mother has already told you that you could not go to the party. If you spend the night away from home and go, your mother will probably not find out.

**Driving Force** ←-----→ **Conflict**

Human vs. Self

Should you spend the night with your friend and go to the party against your mother's wishes?

**Resolution:** This will be the decision you make.

**Setting:** Kip, Peewee and the Mother Thing want to escape from the spaceship where they are being held captive.

**Situation:** Kip, Peewee and the Mother Thing have an opportunity to escape from the spaceship when the two space pirates are not on guard. They are on the surface of the moon.

**Driving Force** ←-----→ **Conflict**

Human vs. Nature

The moon does not have oxygen for them to breathe.

**Resolution:** They steal oxygen bottles and use the space suits to escape.

Describe three more conflict situations from the novel.

## Language Arts Lesson 6: Compare and Contrast

**LESSON LENGTH:** 1-2 days

**NOVEL EXCERPT:** Page 45 (I was face up but... to ... He had no expression in his speech)

**BACKGROUND INFORMATION:** Kip Russell has been skyjacked by a monstrous extraterrestrial. This is the part of the novel where Kip sees Wormface for the first time.

### PROCEDURE

#### Part One:

1. Have the students read the passage. Tell the students that two different creatures are interacting in this passage. One is a human and the other is an extraterrestrial called "Wormface." Both of these characters can be considered "aliens" when compared to each other. Each alien has a home planet. One can infer things about a planet by looking at the things that inhabit it. In his description Kip refers to the Wormface as having squat legs, maybe from a high gravity planet. Kip also says that Wormface is an oxygen breather but he did not see where the oxygen was going in. This tells us that the planet has some sort of gravity and atmosphere. Later, Wormface asks about the amount of protein on our planet. This infers that they know what protein is and have a need for it; otherwise, why ask? The logical assumption here will be diet. Unfortunately, we are made of protein.
2. The students will be making a Venn diagram comparing and contrasting the two aliens. They will have many different answers that could be correct on the differences. On the overlap with the likenesses they should have things such as eyes, oxygen breathers, brain-intelligence, ability to communicate, mouth, teeth, legs, mobility, waist, arms, etc.
3. Do a Venn Diagram as a group after the students have a chance to do theirs and point out the important differences.

#### Part Two:

The students will now use the information from their Venn Diagram and write a paper called "Lifestyles of the Rich and Alien" comparing what a day would be like for each of our aliens. The day would be based on each being on their home planets.

## TEXT EXCERPTS FROM

Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt page 27: Used in science lesson 1**

Suited up, with bottles on my back, I weighed more than twice what I do stripped. Besides that, although the joints were constant-volume, the suit didn't work as freely under pressure. Dress yourself in heavy fishing waders, put on an overcoat and boxing gloves and a bucket over your head, then have somebody strap two sacks of cement across your shoulders and you will know what a space suit feels like under one gravity.

But ten minutes later I was handling myself fairly well and in half an hour I felt as if I had worn one all my life. The distributed weight wasn't too great (and I knew it wouldn't amount to much on the Moon). The joints were just a case of getting used to more effort. I had had more trouble learning to swim.

It was a blistering day: I went outside and looked at the Sun. The polarizer cut the glare and I was able to look at it. I looked away; polarizing eased off and I could see around me.

I stayed cool. The air, cooled by semi-adiabatic expansion (it said in the manual), cooled my head and flowed on through the suit, washing away body heat and used air through the exhaust valves. The manual said that heating elements rarely cut in, since the usual problem was to get rid of heat; I decided to get dry ice and force a test of thermostat and heater.

I tried everything I could think of. A creek runs back of our place and beyond is a pasture. I slogged through the stream, lost my footing and fell- the worst trouble was that I could never see where I was putting my feet. Once I was down I lay there a while, half floating but mostly covered. I didn't get wet, I didn't get hot, I didn't get cold, and my breathing was as easy as ever even though water shimmered over my helmet.

I scrambled heavily up the bank and fell again, striking my helmet against a rock. No damage, Oscar was built to take it. I pulled my knees under me, got up, and crossed the pasture, stumbling on rough ground but not falling. There was a haystack there and I dug into it until I was buried.

Cool fresh air... no trouble, no sweat.

After three hours I took it off. The suit had relief arrangements like any pilot's outfit but I hadn't rigged it yet, so I had come out before my air was gone. When I hung it in the rack I had built, I patted the shoulder yoke. "Oscar, you're all right," I told it. "You and I are partners. We're going places."

I would have sneered at five thousand dollars for Oscar.

While Oscar was taking his pressure tests I worked on his electrical and electronic gear. I didn't bother with a radar target or beacon; the first is childishly simple, the second is fiendishly expensive. But I did want radio for the space-operations band of the spectrum- the antennas suited only those wavelengths. I could have built an ordinary walkie-talkie and hung it outside- but I would have been kidding myself with a wrong frequency and gear that might not stand vacuum. Changes in pressure and temperature and humidity do funny things to electronic circuits; that is why the radio was housed inside the helmet.

The manual gave circuit diagrams, so I got busy. The audio and modulating circuits were no problem, just battery-operated transistor circuitry which I could make plenty small enough. But the microwave part-

It was a two-headed calf, each with transmitter and receiver- one centimeter wavelength for the horn and three octaves lower at eight centimeters for the spike in a harmonic relationship, one crystal controlling both. This gave more signal on broadcast and better aiming when squirting out the horn and also meant that only part of the rig had to be switched in changing antennas. The output of a variable-frequency oscillator was added to the crystal frequency in tuning the receiver. The circuitry was simple- on paper.

But microwave circuitry is never easy; it takes precision machining and a slip of a tool can foul up the impedance and ruin a mathematically calculated resonance.

Well, I tried. Synthetic precision crystals are cheap from surplus houses and some transistors and other components I could vandalize from my own gear. And I made it work, after the fussiest pray-and-try-again I have ever done. But the consarned thing simply would *not* fit into the helmet.

Call it moral victory- I've never done better work.

I finally bought one, precision made and embedded in plastic, from the same firm that sold me the crystal. Like the suit it was made for, it was obsolete and I paid a price so low that I merely screamed. By then I would have mortgaged my soul- I wanted that suit to *work*.

The only thing that complicated the rest of the electrical gear was that everything had to be either "fail-safe" or "no-fail"; a man in a space suit can't pull into the next garage if something goes wrong- the stuff *has* to keep on working or he becomes a vital statistic. That was why the helmet had twin headlights; the second cut in if the first failed- even the peanut lights for the dials over my head were twins. I didn't take short cuts; every duplicate circuit I kept a duplicate and tested to make sure that automatic changeover always worked.

TEXT EXCERPTS FROM

Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt page 41: Used in science lesson 2**

"But right now I think we had better hang on. We ought to be at halfway point in a few minutes- and a skew-flip is disconcerting even if you are strapped down."

I had read about skew-flip turn-overs, but only as a theoretical maneuver; I had never heard of a ship that could do one. If this was a ship. The floor felt as solid as concrete and as motionless. "I don't see anything to hang on to."

"Not much, I'm afraid. But if we sit down in the narrowest part and push against each other, I think we can brace enough not to slide around. But let's hurry; my watch might be slow."

We sat on the floor in the narrow part where the angled walls were about five feet apart. We faced each other and pushed our shoes against each other, each of us bracing like an Alpinist inching his way up a rock chimney- my socks against her tennis shoes, rather, for my shoes were still on my workbench, so far as I knew. I wondered if they had simply dumped Oscar in the pasture and if Dad would find him.

"Push hard, Kip, and brace your hands against the desk."

I did so. "How do you know when they'll turn over, Peewee?"

"I haven't been unconscious- they just tripped me and carried me inside- so I know when we took off. If we assume that the Moon is their destination, as it probably is, and if we assume one gravity the whole jump- which can't be far off; my weight feels normal. Doesn't yours?"

I considered it. "I think so."

"Then it probably is, even though my own sense of weight may be distorted from being on the Moon. If those assumptions are correct, then it is almost exactly a three-and-a-half-hour trip and-" Peewee looked

at her watch. “-E.T.A. should be nine-thirty in the morning and turn-over at seven-forty-five. Any moment now.”

“Is it that late?” I looked at my watch. “Why, I’ve got a quarter of two.”

“You’re on your zone time. I’m on Moon time-Greenwich time, that is. Oh, oh! Here we go!”

The floor tilted, swerved, and swooped like a roller coaster, and my semicircular canals did a samba. Things steadied down as I pulled out of acute dizziness.

“You all right?” asked Peewee.

I managed to focus my eyes. “Uh, I think so. It felt like a one-and-a-half gainer into a dry pool.”

“This pilot does it faster than I dared to. It doesn’t really hurt, after your eyes uncross. But that settles it. We’re headed for the Moon. We’ll be there in an hour and three quarters.”

I still couldn’t believe it. “Peewee? What kind of ship can gun at one gee all the way to the Moon? They been keeping it secret? And what were *you* doing on the Moon anyhow? Anyway why were you stealing a ship?

TEXT EXCERPTS FROM

Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt page 52: Used in science lesson 3.**

When I was a kid, we used to pretend we were making the first landing on the Moon. Then I gave up romantic notions and realized that I would have to go about it another way. But I never thought I would get there penned up, unable to see out, like a mouse in a shoe box.

The only thing that proved I was on the Moon was my weight. High gravity can be managed anywhere, with centrifuges. Low gravity is another matter; on Earth the most you can squeeze out is a few seconds going off a high board, or by parachute delay, or stunts in a plane.

If low gravity goes on and on, then wherever you are, you are *not* on Earth. Well, I wasn’t on Mars; it had to be the Moon.

On the Moon I should weigh a little over twenty-five pounds. It felt about so- I felt light enough to walk on a lawn and not bend the grass.

For a few minutes I simply exulted in it, forgetting *him* and the trouble we were in, just heel-and-toe around the room, getting the wonderful feel of it, bouncing a little and bumping my head against the ceiling and feeling how slowly, slowly, slowly I settled back to the floor. Peewee sat down, shrugged her shoulders and gave a little smile, an annoyingly patronizing one. The “Old Moon-Hand” – all two weeks more of it than I had had.

Low gravity has its disconcerting tricks. Your feet have hardly any traction and they fly out from under you. I had to learn with muscles and reflexes what I had known only intellectually: that when weight goes down, mass and inertia do not. To change direction, even in walking, you have to lean the way you would to round a turn on a board track- and even then if you don’t have traction (which I didn’t in socks on a smooth floor) your feet go out from under you.

A fall doesn't hurt much in one-sixth gravity but Peewee giggled. I sat up and said, "Go and laugh, smartie. You can afford to- you've got tennis shoes."

"I'm sorry. But you looked silly, hanging there like a slow-motion picture and grabbing air."

"No doubt. Very funny."

"I said I was sorry. Look, you can borrow my shoes."

I looked at her feet, then at mine, and snorted. "Gee, thanks!"

"Well... you could cut the heels out, or something. It wouldn't bother me. Nothing ever does. Where are your shoes, Kip?"

"Uh, about a quarter-million miles away- unless we got off at the wrong stop."

"Oh. Well, you won't need them much, here."

"Yeah." I chewed my lip, thinking about "here" and no longer interested in games with gravity. "Peewee? What do we do now?"

"About what?"

"About *him*."

"Nothing. What *can* we do?"

"Then what do we do?"

"Sleep."

"Huh?"

"Sleep. 'Sleep, that knits up the ravell'd sleeve of care.' 'Tired Nature's sweet restorer, balmy sleep.' 'Blessings on him who invented sleep, the mantle that covers all human thoughts.'"

"Quit showing off and talk sense!"

"I *am* talking sense. At the moment we're as helpless as goldfish. We're simply trying to survive- and the first principle of survival is not to worry about all the impossible and concentrate on what's possible. I'm hungry and thirsty and uncomfortable and very, very tired... and all I can do about it is sleep. So if you will kindly keep quiet, that's what I'll do."

TEXT EXCERPTS FROM

Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt Pg 89: Used in science lesson 4.**

I had wondered how we could be so lost so close to human habitation – and how crawly monsters could hide a base only forty miles from Tombaugh Station. Well, I had time to think and could figure it out because I could see the Moon around me.

Compared with the Moon the Arctic is swarming with people. The Moon's area is about equal to Asia – with fewer people than Centerville. It might be a century before anyone explored that plain where

Wormface was based. A rocket ship passing over wouldn't notice anything even if camouflage hadn't been used; a man in a space suit would never go there; a man in a crawler would find their base only by accident even if he took the pass we were in and ranged around that plain. The lunar mapping satellite could photograph it and rephotograph, then a technician in London might note a tiny difference on two films. Maybe. Years later somebody might check up – if there wasn't something more urgent to do in a pioneer outpost where *everything* is new and urgent.

As for radar sightings – there were unexplained radar sightings before I was born.

Wormface could sit there, as close to Tombaugh Station as Dallas is to Fort Worth, and not fret, snug as a snake under a house. Too many square miles, not enough people.

Too incredibly many square miles...Our whole world was harsh bright cliffs and dark shadows and black sky and endless putting one foot in front of the other.

But eventually we were going downhill oftener than up and at weary last we came to a turn where we could see out over a hot bright plain. There were mountains awfully far away; even from our height, up a thousand feet or so, they were beyond the horizon. I looked out over that plain, too dead beat to feel triumphant, then glanced at Earth and tried to estimate due West.

Pewee touched her helmet to mine. "There it is, Kip."

"Where?" She pointed and I caught a glint on a silvery dome.

The Mother Thing trilled at my spine. "What is it, children?"

"Tombaugh Station, Mother Thing."

Her answer was wordless assurance that we were good children and that she had known that we could do it.

The station may have been ten miles away. Distances were hard to judge, what with that funny horizon and never anything for comparison – I didn't even know how big the dome was. "Peewee, do we dare use radio?"

She turned and looked back. I did also; we were about as alone as could be. "Let's risk it."

"What frequency?"

"Same as before. Space operations. I think."

So I tried. "Tombaugh Station. Come in, Tombaugh Station. Do you read me?" Then Peewee tried. I listened up and down the band I was equipped for. No luck.

I shifted to horn antenna, aiming at the glint of light. No answer.

"We're wasting time, Peewee. Let's start slogging."

She turned slowly away. I could feel her disappointment – I had trembled with eagerness myself. I caught up with her and touched helmets. "Don't let it throw you, Peewee. They can't listen all day for us to call. We see it, now we'll walk it."

"I know," she said dully.



As we started down we lost sight of Tombaugh Station, not only from twists and turns but because we dropped it below the horizon. I kept calling as long as there seemed any hope, then shut it off to save breath and battery.

TEXT EXCERPTS FROM  
Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt page 101: Used in science lesson 5.**

The outer door opened and I had my first view of Pluto.

I don't know what I expected. Pluto is so far out that they can't get decent photographs even at Luna Observatory. I had read articles in the *Scientific American* and seen pictures in *LIFE*, bonestelled to look like photographs, and remembered that it was approaching its summer- if "summer" is the word for warm enough to melt air. I recalled that because they had announced that Pluto was showing an atmosphere as it got closer to the Sun.

But I had never been much interested in Pluto- too few facts and too much speculation, too far away and not desirable real estate. By comparison the Moon was a choice residential suburb. Professor Tombaugh (the one the station was named for) was working on a giant electronic telescope to photograph it, under a Guggenheim grant, but he had a special interest; he discovered Pluto years before I was born.

The first thing I noticed as the door was opening was *click...click...click*- and a fourth click, in my helmet, as Oscar's heating units all cut in.

The Sun was in front of me- I didn't realize what it was at first; it looked no bigger than Venus or Jupiter does from Earth (although much brighter). With no disc you could be sure of, it looked like an electric arc.

Fats jabbed me in the ribs. "Snap out of your hop."

A drawbridge joined the door to an elevated roadway that led into the side of a mountain about two hundred yards away. The road was supported on spidery legs two or three feet high up to ten or twelve, depending on the lay of the land. The ground was covered with snow, glaringly white even under that pinpoint Sun. Where the stilts were longest, about halfway, the viaduct crossed a brook.

What sort of "water" was that? Methane? What was the "snow"? Solid ammonia? I didn't have tables to tell me what was solid, what was liquid, and what was gas at whatever hellish cold Pluto enjoyed in the "summer." All I knew was that it got so cold in its winter that it didn't have any gas or liquid- just vacuum, like the Moon.

I was glad to hurry. A wind blew from our left and was not only freezing that side of me in spite of Oscar's best efforts, it made the footing hazardous- I decided it would be far safer to do that forced march on the Moon again than to fall into that "snow." Would a man struggle before he shattered himself and his suit, or would he die as he hit?

Adding to hazard of wind and no guard rail was traffic, spacesuited wormfaces. They moved at twice our speed and shared the road the way a dog does a bone. Even Skinny resorted to fancy footwork and I had three narrow squeaks.

The way continued into a tunnel; ten feet inside a panel snapped out of the way as we got near it. Twenty feet beyond was another; it did the same and closed behind us. There were about two dozen panels, each behaving like fast-acting gate valves, and the pressure was a little higher after each. I couldn't see what operated them although it was light in the tunnel from glowing ceilings. Finally we passed though a

heavy-duty air lock, but the pressure was already taken care of and its doors stood open. It led into a large room.

Wormface was inside. *The Wormface*, I think, because he spoke in English: "Come!" I heard it through my helmet.

TEXT EXCERPTS FROM  
Heinlein, Robert A. *Have Space Suit Will Travel*. New York: Ballentine Books, 1958.

**Excerpt page 45: Used in science lesson 6 and language arts lessons 1,2,3,6.**

I was face up but it took time to realize this must be the control room. It didn't look like anything any human would design as a control room, which wasn't surprising as no human had. Then I saw *him*.

Peewee needn't have warned me; I didn't want to antagonize *him*.

The little guy was tough and dangerous, the fat guy was mean and murderous; they were cherubs compared with *him*. If I had had my strength I would have fought those two any way they like; I don't think I'm too afraid of any human as long as the odds aren't impossible.

But not *him*.

*He* wasn't human but that wasn't what hurt. Elephants aren't human but they are very nice people. *He* was built more like a human than an elephant is but that was no help- I mean he stood erect and had feet at one end and a head at the other. He was no more than five feet tall but that didn't help either; he dominated us the way a man dominates a horse. The torso part was long a mine; his shortness came from very squat legs, with feet (I guess you would call them feet) which bulged out, almost disc-like. They made squashy, sucking sounds when he moved. When he stood still a tail, or third leg, extruded and turned him into a tripod- he didn't need to sit down and I doubt if he could.

Short legs did not make him slow. His movements were blurringly fast, like a striking snake. Does this mean a better nervous system and more efficient muscles? Or a native planet with higher gravity?

His arms looked like snakes- they had more joints than ours. He had two sets, one pair where his waist should have been and another set under his head. No shoulders. I couldn't count his fingers, or digit tendrils; they never held still. He wasn't dressed except for belt below and above the middle arms which carried whatever such a thing carries in place of money and keys. His skin was purplish brown and looked oily.

Whatever *he* was, he was *not* the same race as the Mother Thing.

He had a faint sweetish musky odor. Any crowded room smells worse on a hot day, but if I ever whiff that odor again, my skin will crawl and I'll be tongue-tied with fright.

I didn't take in these details instantly; at first all I could see was his face. A "face" is all I can call it. I haven't described it yet because I'm afraid I'll get the shakes. But I will, so that if you ever see one, you'll shoot first, before your bones turn to jelly.

No nose. He was an oxygen breather but where the air went in and out I couldn't say- some of it through the mouth, for he could talk. The mouth was the second worst part of him; in place of jawbone and chin he had mandibles that opened sideways as well as down, gaping in three irregular sides. There were rows of tiny teeth but no tongue that I could see; instead the mouth was rimmed with cilia as long as angleworms. They never stopped squirming.

I said the mouth was “second worst”; he had eyes. They were big and bulging and protected by horny ridges, two on the front of his head, set wide apart.

They scanned. They scanned like radar, swinging up and down and back and forth. He never looked at you and yet was *always* looking at you.

When he turned around, I saw a third eye in back. I think he scanned his whole surroundings at all times, like a radar warning system.

What kind of brain can put together everything in all directions at once? I doubt if a human brain could, even if there were any way to feed in the data. He didn't seem to have room in his head to stack much of a brain, but maybe he didn't keep it there. Come to think of it, humans wear their brains in an exposed position; there may be better ways.

But he certainly had a brain. He pinned me down like a beetle and squeezed out what he wanted. He didn't have to stop to brain-wash me; he questioned and I gave, for an endless time- it seemed more like days than hours. He spoke English badly but understandably. His labials were all alike- “buy” and “pie” and “vie” sounded the same. His gutturals were harsh and his dentals had a clucking quality. But I could usually understand and when I didn't, he didn't threaten or punish; he just tried again. He had no expression in his speech.