

USING NOVELS IN THE SCIENCE CLASSROOM TO INCREASE LITERACY IN MIDDLE
SCHOOL STUDENTS

by

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PROJECT SUMMARY

Science can be a tricky subject to teach in terms of the literacy demand of students. Science teachers need to teach a large number of new vocabulary words every year which students are unlikely to see again outside of science. Students also need to be able to read a science text which is very different and more difficult than a non-fiction text from English language arts (ELA) or social studies (Moje, 2008). Students need special instruction in reading a science text in order to retain the information (Biancarosa & Snow, 2004), which they often do not receive (Ness, 2007). Additionally, an increasing number of students are English language learners (ELL). As of a survey in 2015, the national average was about 10% of students were ELL and in Minnesota the percentage of ELL students in public schools was 8.2% (National Center for Education Statistics, 2018).

I teach middle school science at a school which is 90% ELL and whose students are mostly below their grade level in reading. I decided to create my project around trying to aid students in their literacy skills while addressing the ELL needs at the same time in science. Due to the difficulty level of science textbooks and my ultimate goal of increasing literacy in students I decided to use novels with a scientific basis as the mode to not only deliver science content but also to increase student interest in science and literacy. My research question is *How does the use of novels in the middle school science classroom impact student reading and literacy skills among ELL students?*

For this project, I created a supplementary curricular unit for use within the large space unit in an eighth grade science classroom. I started with one novel for eighth grade students,

though I intend to add sixth and seventh grade over the course of the next few years. I created a supplementary unit around the central research question with a focus on adapting the methodology for ELL students. The eighth grade students read *The Martian: Young Reader's Edition* by Andy Weir as a class and completed various assignments with the novel along the way. Each assignment was designed to aid students in developing literacy skills as well as science specific content related to the space unit.

The supplementary curriculum surrounding *The Martian* was created using Wiggins and McTighe's (2011) backward design approach (p. 5). The approach starts with deciding on the desired outcome of the curriculum being created or designed, then deciding on what the evidence of learning will be, and finally creating the learning plan. Using Wiggins and McTighe (2011), the end goal of this project was to increase literacy and reading skills as they pertain to the science in a group of eighth grade students. After deciding on this goal, I decided to grade based on a rubric that shows what proficient student work would look like (p. 16). Finally, I decided on the method by which students would accomplish this work.

The curriculum for *The Martian* is comprised of a number of different elements specific to ELL students and their needs. A combination of reading strategies, comprehension questions, entrance tickets, small group work, and whole class discussion were used in the supplementary unit (p. 9). The unit begins with a NASA activity (NASA, n.d.) designed to get students thinking about Mars exploration and what it takes in order to carry out such a mission. Reading strategies are introduced throughout the unit to aid in student comprehension. Students are taught the reading strategies at the beginning of the unit and then are asked to use the different strategies throughout the unit with their reading of the novel.

At the end of the large space unit, students were able to watch the film, *The Martian*, (Producer Goddard, Producer Kinberg, & Director Scott, 2015) and write a critique on the similarities and differences between the book and film (ELA standard 8.4.7.7). The curriculum for use with the space mega-unit helps to fulfill science Minnesota standards 8.1.1.2.1, 8.1.3.3.1, 8.1.3.3.2, 8.1.3.3.3, 8.3.3.1.2, and 8.3.3.1.3 (p. 5). The end of goal of curriculum using *The Martian* is to increase student awareness of what it takes to explore space and for humans to live out there. Students are able to live through this experience in *The Martian* while also increasing their scientific knowledge of space including the physics and chemistry necessary in order to live. Having students read the book as opposed to simply watching the movie also allows them to increase their literary and reading skills as well as their scientific knowledge.

The following information is the unit for *The Martian* as well as all the supporting material that goes with the unit including an implementation calendar, lesson design template, lesson plans, and handouts.

Backwards Design Template-*The Martian* Supplementary Curriculum

Adapted from Wiggins & McTighe 2011

Title of Supplementary Unit:	Novel Study- <i>The Martian</i> by Andy Weir	Grade Level:	8 th Grade
Curriculum Area:	Space	Time Frame:	~ 7-8 weeks
Created by:	Elizabeth Das		
Stage 1-Desired Results			
Content Standards			
Science Standards:			
8.1.1.2.1-Use logical reasoning and imagination to develop descriptions, explanations, predictions and models based on evidence (MN Dept. of Education, 2010, p.22)			
8.1.3.3.1-Explain how scientific laws and engineering principles, as well as economic, political, social, and ethical expectations, must be taken into account in designing engineering solutions or conducting scientific investigations (MN Dept. of Education, 2010, p.22)			
8.1.3.3.2-Understand that scientific knowledge is always changing as new technology and information enhance observations and analysis of data (MN Dept. of Education, 2010, p.22)			
8.1.3.3.3-Provide examples of how advances in technology have impacted how people live, work, and interact (MN Dept. of Education, 2010, p.22)			
8.3.3.1.2-Describe how gravity and inertia keep most objects in the solar system in regular and predictable motion (MN Dept. of Education, 2010, p.25)			
8.3.3.1.3-Recognize that gravitational force exists between any two objects and describe how the masses of the objects and distance between them affect the force (MN Dept. of Education, 2010, p.25)			
English Language Arts Standards:			
8.4.7.7-Analyze the extent to which a filmed or live production of a story or drama stays faithful to or departs from the text or script, evaluating the choices made by the director or actors (MN Dept. of Education, 2017, p. 51)			
Understandings <i>Students will understand...</i>		Essential Questions	
-The difficulties of surviving in space and on a planet other than Earth -The ethics involved in space travel and colonization of a new planet		-Why do people want to explore our solar system? -What technology is needed for us to explore our system?	

<ul style="list-style-type: none"> -The politics involved in space travel and colonization of a new planet -The difficulty of planning and safely executing space travel 	<ul style="list-style-type: none"> -How does <i>The Martian</i> illustrate humanity's desire to explore other worlds? -What would it take for a person to survive on a planet different from Earth? -What scientific knowledge do we need in order to explore and colonize another planet? -What ethical considerations (such as 6 people living in close quarters, whether NASA really has to rescue a stranded astronaut, etc.) were taken into account or shown in <i>The Martian</i>? -What were the political ramifications of decisions made by NASA in <i>The Martian</i>?
<p>Knowledge <i>Students will know...</i></p>	<p>Skills <i>Students will be able to...</i></p>
<ul style="list-style-type: none"> -The scientific principles needed for accurate and safe space exploration (such as gravity, inertia, air chemistry, growing food, etc.) -The technology needed for a person to survive on a planet like Mars 	<ul style="list-style-type: none"> -Use research skills to find out about technology used in current space travel and what is needed for future space travel -Express their thoughts about the reading in writing and orally -Use different reading strategies effectively to aid in comprehension
Stage 2-Assessment Evidence	
Evaluative Criteria	Performance Tasks:
<ul style="list-style-type: none"> -Clear and concise sentences -Good Detail -Informative -Accurate to novel -Accurate science 	<ul style="list-style-type: none"> -Completion of reading question sets and chapter summaries -1 to 2 page critique of movie versus novel
Other Evidence	
<ul style="list-style-type: none"> -Well spoken -Clear and concise idea/structures 	<p>Formative Assessments: Participation in small group and class discussions, Marsbound! NASA activity questions (NASA, n.d.), entrance tickets</p> <p>Summative Assessments: End of book question set, movie and novel critique</p>
Stage 3-Learning Plan	
Summary of Key Learning Events and Instruction	
<p>The importance of the novel <i>The Martian</i> lies in its connection to the 3 units on space that coincide with the reading of the novel. The novel is meant to aid student understanding in life on other planets and what that may look like as well as the need for technology and the difficulty of space travel.</p> <p>Pre-reading activity: Marsbound! NASA activity (NASA, n.d., https://www.jpl.nasa.gov/edu/teach/activity/marsbound/)-Students will complete an</p>	

activity taking approximately 135 minutes that simulates a mission to Mars and the problems that astronauts face as well as the job of astronauts.

Successive Readings: Every 2-3 days students will spend approximately 15-20 minutes of class time discussing the latest reading and talking about reading strategies as they pertain to *The Martian* through small group and whole class work. Students will largely be assigned readings and writing components as homework, though extra class time may be devoted to these as deemed necessary by the teacher.

After the book has been read: Students will complete several long answer questions regarding the entire book. Some questions may require some online research by the students depending on student knowledge base. Some additional class time will be devoted to the questions and discussion of the questions as well as for brainstorming ideas and creating outlines for question answers. Additionally, students will watch the film version of *The Martian* (Producer Goddard, Producer Kinberg, & Director Scott, 2015) and write a one to two page critique of the film versus the book. All students will get a copy of the grading rubric to be used for the long answer questions and the movie critique.

Lesson Plan Calendar

*Note 1: Most lessons should be spaced 2-3 days apart to give students time to complete the homework.

*Note 2: On days where nothing is noted or time allocated is less than 45 min, material from the space unit is covered.

Week 1	Day 1 Lesson 1 (45 min)	Day 2 Lesson 1 (45 min)	Day 3 Lesson 1 (45 min)	Day 4 Lesson 2 (45 min)	Day 5
Week 2	Day 6	Day 7	Day 8 Lesson 3 (25 min)	Day 9	Day 10
Week 3	Day 11	Day 12 Lesson 4 (25 min)	Day 13	Day 14	Day 15
Week 4	Day 16 Lesson 5 (15 min)	Day 17	Day 18	Day 19 Lesson 6 (20 min)	Day 20
Week 5	Day 21	Day 22 Lesson 7 (15 min)	Day 23	Day 24	Day 25 Lesson 8 (25 min)
Week 6	Day 26	Day 27	Day 28 Lesson 9 (15-20 min)	Day 29	Day 30
Week 7	Day 31 Lesson 10 (45 min)	Day 32	Day 33 Lesson 11 (45 min)	Day 34 Lesson 11 (15 min)	Day 35
Week 8	Day 36 Lesson 12 (45 min)	Day 37 Lesson 12 (45 min)	Day 38 Lesson 12 (45 min)	Day 39	Day 40

Lesson Plan Overview

*Note: Most lessons are designed to be used every 3-4 days in order to give students time to complete the homework reading assignments. Only a few lessons may be used consecutively

Lesson 1	
Time Required:	135 minutes (~3 days)
Essential Question(s):	How do you plan a trip to Mars? What considerations need to be taken into account when planning a mission to Mars?
Objectives/Goals:	<ol style="list-style-type: none"> 1. Be able to list NASA's goals for Mars Exploration 2. Design a mission to Mars
Content:	<p>Lesson follows Marsbound! NASA activity (NASA, n.d., https://www.jpl.nasa.gov/edu/teach/activity/marsbound/) and uses all materials from the activity including activity worksheets.</p> <ol style="list-style-type: none"> 1. Introduction and Activity 1: Students identify NASA's goals for Mars exploration and sort questions based in those goals 2. Activity 2: Students discuss possible science objectives for their mission and decide whether they will use a lander, orbiter, or fly-by mission. 3. Activity 3: Students design spacecraft for the mission by playing the game. Students must stay within budget, power, and mass. 4. Activity 4: Students think about their mission limitations and accommodations and then share with the class. Students are then given a new problem according to the simulation (and time available). Students complete post-ideas worksheet.
Lesson 2	
Time Required:	45 min.
Essential Question(s):	What technology is needed for us to explore our solar system?
Objectives/Goals:	Be able to use Reading strategy 1 (Interactive editing) effectively to summarize a chapter
Content:	<ol style="list-style-type: none"> 1. Teacher reads back cover of book, then reads first chapter aloud. Students should take notes about words they don't understand, the characters, setting, and what is taking place.. 2. Think-Pair-Share (TPS): Students write down a summary of the chapter and identify words they do not understand or what was unclear. They share what they have written with a partner and then teacher picks groups to share with the class.

	<ol style="list-style-type: none"> 3. Teacher goes back into the reading and identifies words students do not understand and asks clarifying questions. 4. Reading Strategy 1: Interactive Editing (Román et al., 2018) using p. 2-3 on Mars missions which contains a lot of vocabulary and acronyms. Give all students a copy of “Reading Strategies” so that they have them for later use with their own reading of the novel. Below are the directions for reading strategy 1 from the Reading Strategies guide (p. 17). <ol style="list-style-type: none"> a) Select a section of meaningful paragraphs or small section. b) Choral read the text-This allows students to hear what words sound like c) With the help of students, select keywords or phrases (focus on nominalizations and connecting words) d) Use keywords to collaboratively rewrite the text in the students’ own language, underlining the keywords e) Can be used later to jigsaw texts. 5. Students get grading rubric (p. 16) for the entirety of the book. Teacher explains that the grading rubric will be used for the reading packets and the movie critique. Students should use the rubric when completing their answers and critique in order to make sure that the information in it is complete.
Homework:	<p>-Read chapters 2-4 using reading strategy 1; assign each student one chapter to use the strategy with (they should not do all 3 chapters)</p> <p>-Fill out acronym/important terms section in <i>The Martian</i> Part 1 reading packet (p. 18) as encounter terms in the reading (not all will be encountered yet)</p>
Lesson 3	
Time Required:	25 min.
Essential Question(s):	What technology is needed for us to explore our solar system? What would it take for a person to survive on a planet different from Earth?
Objectives/Goals:	<ol style="list-style-type: none"> 1. Be able to identify the problems Mark faced and how he solved them 2. Be able to use Reading Strategy 2 effectively to summarize a chapter
Content:	<ol style="list-style-type: none"> 1. Entrance ticket: How did Mark decide to solve his food problem? What did he do to fix the problem of getting enough water for his food problem fix? 2. Whole class discussion revisiting chapters 2-4

	<ol style="list-style-type: none"> 3. In pairs, students share their rewrite of the chapter they focused on for reading strategy 1 4. Students discuss in small groups how using the reading strategy went and then share with the class 5. Reading Strategy 2: SQ3R (Survey, Question, Read, Recite, Review) (Martin, 2006) using chapter 4 as an example. Walk students how to use the strategy according to the directions below. Refer to their own copy of the reading strategies guide (p.17) frequently by asking students to read the next step aloud to the class. Ask for student input along the way. <ol style="list-style-type: none"> a) Students survey the chapter to be read, glancing through the text, noticing the headings and any changes in the text font b) Students pose questions based on the survey and what they have read before about what will happen in the text c) Students read the text d) Students recite the main idea or summarize by writing e) Students review the questions that they wrote and answer them if they can and/or write new questions based on what they read
Homework:	<p>-Read chapters 5-7 using reading strategy 2</p> <p>-Answer questions 1-4 in Part 1 reading packet (p.18); fill in missing acronyms</p>
Lesson 4	
Time Required:	25 min.
Essential Question(s):	What would it take for a person to survive on a planet different from Earth? What are the political ramifications of decisions made by NASA in <i>The Martian</i> ?
Objectives/Goals:	Be able to use Reading Strategy 3 effectively to take notes and predict
Content:	<ol style="list-style-type: none"> 1. TPS: Write short summary of what Watney has accomplished so far. Share with partner and add things that you missed. Share with the class. 2. Class vote on which strategy students liked the best. Call on volunteers for why they preferred one over the other. Ask students about difficulties with the two strategies so far. 3. Reading strategy 3: Understanding the Text (Martin, 2006)-Model the strategy using chapter 7 from the book being to think out loud for step b. Refer students to their reading

	<p>strategies guide (p.17) for the steps. Use the instructions below to model the strategy.</p> <p>a) Read the chapter and take notes on the sequence of events to help clarify what is happening</p> <p>b) Stop periodically to question what is happening in the text and evaluate if the text is understood</p> <p>c) Reread the chapter to revise understanding</p> <p>d) Predict what will happen next</p>
Homework:	Read chapters 8-10 using reading strategy 3
Lesson 5	
Time Required:	15 min.
Essential Question(s):	What scientific knowledge do we need in order to explore and colonize a planet? What would it take for a person to survive on a planet different from Earth?
Objectives/Goals:	<ol style="list-style-type: none"> 1. Be able to identify why <i>Pathfinder</i> is critical to Mark's survival 2. Be able to identify the best reading strategy according to themselves
Content:	<ol style="list-style-type: none"> 1. Entrance ticket: What is so exciting about Mark getting <i>Pathfinder</i>? Why? 2. Whole Class Discussion: Brief discussion of what is happening in the book. Teacher should review chapters 8-10 to be sure students hit on the key points. 3. TPS: Individually write about which reading strategy you think works best for you and why. Share with a partner. Do you and the partner have the same one? Share with the class. 4. After giving the homework for next time, be sure to tell students NOT to read ahead.
Homework:	<p>-Read chapters 11-13 using a reading of your choice</p> <p>-Answer questions 5-8 in Part 1 reading packet (p.18)</p>
Lesson 6	
Time Required:	20 min.
Essential Question(s):	What would it take for a person to survive on a planet different from Earth? What are the political ramifications of decisions made by NASA in <i>The Martian</i> ?
Objectives/Goals:	Be able to make a prediction based on Mark's character as to what he will do next.

Content:	<ol style="list-style-type: none"> 1. Reflection: Which reading strategy did you pick for chapters 11-13? How did it help you to better understand the events of the chapters? Write a paragraph. 2. Share reflection in small groups. As a whole share a few reflections then discuss events in chapters 11-13. Have students predict what Mark will do based on his character. 3. Read aloud to class p. 158 and 159. Have students again predict what Mark will do. Discuss first in small groups then share predictions with class. 4. Ask class: What do you think happened to the HAB when the airlock blew? What happened to Mark's crop of potato plants?
Homework:	<p>-Read chapters 14-16 using a different reading strategy from last time</p> <p>-Answer questions 1-3 in Packet 2 (p.20)</p>
Lesson 7	
Time Required:	15 min.
Essential Question(s):	What are the political ramifications of decisions made by NASA in <i>The Martian</i> ?
Objectives/Goals:	<ol style="list-style-type: none"> 1. Be able to identify the problem with the resupply shuttle and why it happened according to scientific principles 2. Be able to identify the politics behind Teddy and Mitch's decisions at the end of chapter 16
Content:	<ol style="list-style-type: none"> 1. Entrance ticket: What happened to the resupply shuttle and why did it happen? What is the science that NASA overlooked? 2. Discuss entrance ticket question in small groups and then as a whole class. 3. Question to be posed to the class: What is the disagreement between Teddy and Mitch? How might these decisions affect Teddy and Mitch politically? What is the eventual outcome by the end of chapter 16?
Homework:	<p>-Read chapters 17-19 using your favorite reading strategy</p> <p>-Answer ques. 4-7 in Packet 2 (p. 20)</p>
Lesson 8	
Time Required:	25 min.
Essential Question(s):	What technology is needed for us to explore our solar system? What would it take for a person to survive on a planet different from Earth?
Objectives/Goals:	Be able to summarize what is currently happening to Watney
Content:	<ol style="list-style-type: none"> 1. Teacher should review chapters 17-19 prior to class. Facilitate whole class discussion of what happened in chapters 17-19, guiding students so that the key points are hit on.

	2. Reading Strategy Review: Assign each table group a reading strategy. Each group creates a review of their assigned strategy including any tips they have found useful. Groups with the same strategy pair up with each other and transfer their combined information to a giant sticky note. Each large group presents their strategy to the class.
Homework:	-Read chapters 20-23 -Answer question 8 in Packet 2 (p.20)
Lesson 9	
Time Required:	15-20 min.
Essential Question(s):	What scientific knowledge do we need in order to explore and colonize another planet? What ethical considerations were taken into account or shown in <i>The Martian</i> ?
Objectives/Goals:	Be able to summarize what is currently happening with Watney
Content:	<ol style="list-style-type: none"> 1. Entrance ticket: What is an “air day” and why does Watney need them? 2. Review chapters 20-23 3. Individual Reflection: If you were in Mark’s position, how would you pass time on the long and boring drives and long battery recharges? Write a short paragraph. 4. If time, read aloud from chapter 24
Homework:	-Read chapters 24-26 -Answer question 1 in Packet 3 (p.22)
Lesson 10	
Time Required:	45 min.
Essential Question(s):	What scientific knowledge do we need in order to explore and colonize another planet? Why do people want to explore our solar system?
Objectives/Goals:	<ol style="list-style-type: none"> 1. Be able to give a prediction about Mark’s life after rescue from Mars 2. Be able to identify how the novel related to science
Content:	<ol style="list-style-type: none"> 1. Review whole novel with special attention to end of book with the class. Share student predictions about Mark’s life after rescue. Discuss how the book pertains to science class and why it is important. 2. Reflection: Write 2 paragraphs on how the novel pertains science class and why it is important. What did you learn? Does the science seem right to you?
Lesson 11	
Time Required:	60 min.

Essential Question(s):	What technology is needed for us to explore our solar system? What scientific knowledge do we need in order to explore and colonize another planet?
Objectives/Goals:	Research energy sources used by Watney in the book
Content:	<ol style="list-style-type: none"> 1. Question 2 in Packet 3 (p.22): Assign table groups an energy source to research. Each group should compile notes on the energy source and summarize on large piece of paper or giant post-it and place on the wall. Give students about 30 minutes to complete this. 2. Each group presents their research to the class. Classmates should take notes on each energy source as they will be required to write 2 pages on them according to the question. Students can take notes in Packet 3.
Homework:	Complete question 2 in Packet 3
Lesson 12	
Time Required:	120 min.
Essential Question(s):	Why do people want to explore our solar system? How does <i>The Martian</i> illustrate humanity's desire to explore other worlds?
Objectives/Goals:	Be able to compare and contrast the 2015 film, <i>The Martian</i> , to the novel
Content:	Watch the 2015 film, <i>The Martian</i> . Students may want to take notes (can be done in Packet 3, p. 22, or their own paper) on similarities and differences between the book and the movie
Homework:	Complete question 3 in Packet 3 (movie critique)

Assessment Rubric

For: Question Responses in Reading Packets and Long-Answer Questions

	1	2	3	4
Scientific Accuracy	Science is not accurate and conclusions are not backed-up with evidence	Science in response is somewhat accurate; conclusions are not backed-up with evidence	Science in response is accurate and some conclusions are backed-up with evidence	Science in response is accurate and conclusions are well-backed up with evidence
Accuracy to Novel	Response is somewhat accurate to the novel	Response is accurate to the novel	Response is accurate to the novel with some evidence from the text	Response is accurate to the novel with evidence from the text
Information	Response has very little detail and is somewhat relevant to the question	Response has some detail and is mostly relevant to the question	Response has good detail and gives relevant information to the question	Response has a lot of detail and gives relevant information to the question
Grammar	Sentences are not quite clear, with many grammar and spelling mistakes	Sentences are clear, with some grammar and spelling mistakes	Sentences are clear, with accurate grammar and spelling	Sentences are clear and concise, with accurate grammar and spelling

Reading Strategies

Strategy 1 (Román et al., 2018)-Interactive Editing

1. Select a section of meaningful paragraphs or small section.
2. Choral read the text-This allows students to hear what words sound like
3. With the help of students, select keywords or phrases (focus on nominalizations and connecting words)
4. Use keywords to collaboratively rewrite the text in the students' own language, underlining the keywords
5. Can be used later to jigsaw texts.

Strategy 2 (as illustrated by Martin, 2006)- SQ3R (Survey, Question, Read, Recite, Review)

*Adapted to fit a fiction novel

1. Students survey the chapter to be read, glancing through the text, noticing the headings and any changes in the text font
2. Students pose questions based on the survey and what they have read before about what will happen in the text
3. Students read the text
4. Students recite the main idea or summarize by writing
5. Students review the questions that they wrote and answer them if they can and/or write new questions based on what they read

Strategy 3 (Martin, 2006)-Understanding the Text

*Adapted to fit a fiction novel

1. Read the chapter and take notes on the sequence of events to help clarify what is happening
2. Stop periodically to question what is happening in the text and evaluate if the text is understood
3. Reread the chapter to revise understanding
4. Predict what will happen next

Lesson Handouts

Name: _____

The Martian Part 1 Reading Packet

Acronyms and Important Terms

MDV = _____

MAV= _____

The Hab = _____

EVA= _____

Oxygenator= _____

Water Reclaimer= _____

JPL= _____

RTG= _____

Pathfinder= _____

Others?

Questions

1. How did Mark fix his hydrogen problem?
2. How did Mindy figure out Mark was still alive?
3. Why does Mark decide to transform one rover and how does he do it?
4. What is the RTG? Why does Mark want to use it? How is it dangerous?

Name: _____

***The Martian* Part 2 Reading Packet**

Questions

1. Look closely at the technology used in the first chapter of the book. What has kept people from carrying out manned space flights to Mars in the real world? Describe what requirements would be needed for this type of mission. Use several sentences.
2. How close are we to having the technology needed for a mission of people staying on Mars for a specific amount of time?
3. Explain how Watney keeps track of time. Where does the word “sol” come from? Why does it make sense to measure time on Mars as sols instead of days? How long is one sol?
4. What does Watney need to do to make the rover able to withstand a trip to Ares 4?
5. What happened to *Pathfinder* and why?
6. Why was Watney hauling rocks? What was the purpose?

Name: _____

The Martian Part 3 Reading Packet

Questions

1. On a separate sheet of paper, write one page predicting what will happen to Mark after being rescued by the crew of the Hermes. What will happen to him? What will the reaction of the general public be like on Earth? Etc.
2. Think about the various energy sources that Watney uses over the course of the book (such as solar cells, radioisotope thermoelectric generators, ion engines, rechargeable batteries). Research each of these. How does each of them work? What are the risks and benefits associated with the various sources of energy? Write 2 pages comparing and contrasting the different types of energy sources on a separate piece of paper.

Directions: Each group will be assigned an energy source to research. Your group will research the topic and come up with notes on the energy source to share with the class. You will need to take notes on what other groups find on their energy sources below and then you will write your answer to the above question.

Solar Cells:

Radioisotope Thermoelectric Generators:

Ion Engines:

Ion Engines Cont'd:

Rechargeable Batteries:

3. **Movie Critique:** You will be watching the 2015 film *The Martian* in class. After the movie, you will write a 1-2 page movie critique, on a separate piece of paper, comparing and contrasting the movie to the book. You may want to take notes and may do so on separate piece of paper or below.

Movie Notes:

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