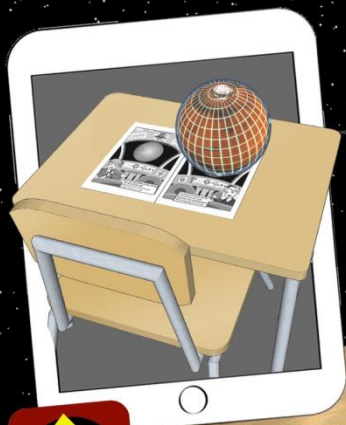
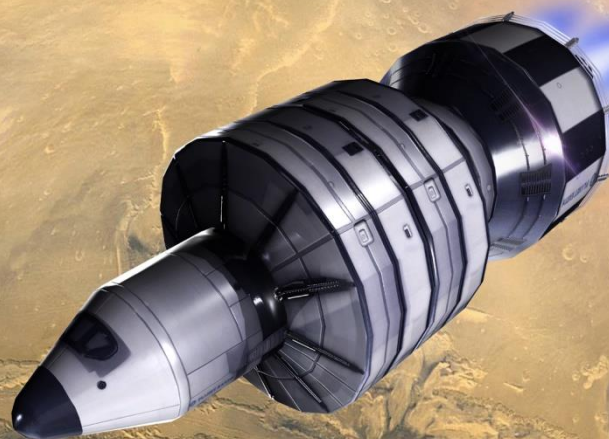


# THE ROCKWELL ADVENTURES® SOLAR SYSTEM EXPEDITION

## TEACHER'S MANUAL



FREE Augmented  
Reality App!



**HANDS ON PLANET EXPLORATION!**



### 3D INTERACTIVE ADVENTURE

- Explore & Measure The Planets
- Land Probes On Each Planet's Surface
- Space Colony Design Challenge
- Pre & Post Exploration Tests
- Correlated to State & National Standards

# INTRODUCTION

## (FOR TEACHERS)

Download the FREE easy to print PDF version of this manual & more at [StoneOakMedia.com](http://StoneOakMedia.com)

### Lesson Plan

*The Rockwell Adventures: Solar System Expedition* is an educational activity book designed to provide 2<sup>nd</sup> – 5<sup>th</sup> graders with a hands-on introduction to the Solar System. The lesson within this book is centered on the premise that the reader will be serving as the lead engineer on a top secret mission to find a planet where a new base can be built.

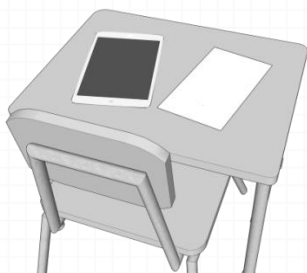
As students travel to each planet in the Solar System, they will record several measurements. These measurements are taken so that, by the end of the mission, the student will know which planet to pick as the location for their base, and what basic design considerations they will need to keep in mind as they draw it.

**IMPORTANT:** A FREE easy-to-print PDF copy of this Teacher's Manual, as well as a variety of Lesson Expansion Packs, are all available for download at [www.StoneOakMedia.com](http://www.StoneOakMedia.com). Before beginning this lesson, print and distribute pages 9, 10, 11, and 12 of this Teacher's Manual to each student.

### Here's How a Typical Lesson is Intended to Work:

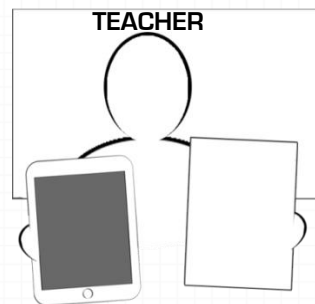


#### 1) DOWNLOAD FREE ZAPPAR APP



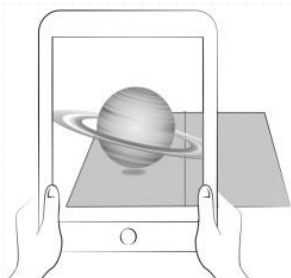
#### 2) PRINT & DISTRIBUTE

- Distribute Books and Printed Lesson Worksheets (Pages 9-12 of this Teacher's Manual) to Students.



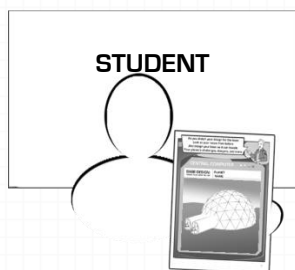
#### 2) INTRODUCE LESSON

Teacher introduces lesson and demonstrates how to complete it



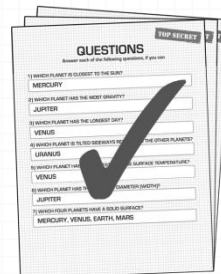
#### 4) STUDENTS EXPLORE

- Pre-Assessment
- Measure Each Planet
- Record Measurements
- Post Assessment
- Design Planet Base



#### 5) STUDENTS PRESENT & VOTE

- Students Present Planet Choice, Base Design, & Rationale
- Class Votes on Best Design
- Optional Lesson Expansion Packs Can Be Done at This Time As Well



#### 6) EXAMINE PROGRESS

- Teacher Compares Pre and Post Assessments

**TOP SECRET**

# ANSWERS

(FOR TEACHERS)

1) WHICH PLANET IS CLOSEST TO THE SUN?

**MERCURY**

2) WHICH PLANET HAS THE MOST GRAVITY?

**JUPITER**

3) WHICH FOUR PLANETS HAVE A SOLID SURFACE?

**MERCURY, VENUS, EARTH, MARS**

4) WHICH PLANET IS TILTED SIDEWAYS RELATIVE TO THE OTHER PLANETS?

**URANUS**

5) WHICH PLANET HAS THE HIGHEST AVERAGE SURFACE TEMPERATURE?

**VENUS**

6) WHICH PLANET HAS THE GREATEST DIAMETER (WIDTH)?

**JUPITER**

7) WHICH PLANET HAS THE LONGEST DAY?















**VENUS**

# ANSWER KEY

**TOP SECRET**

## EXPLORATION NOTES

Record Your Observations of Each Planet

	 TEMPERATURE	 WIDTH (Diameter)	 LENGTH OF DAY	 SURFACE TYPE (Circle One)	 GRAVITY (26 kg on Earth = ?)
 SUN	5,600 °Celsius	1,392,684 km	610.80 Hours	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Gas	726 kg
 MERCURY	167 °Celsius	4,878 km	1,407.36 Hours	<input checked="" type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Gas	10 kg
 VENUS	464 °Celsius	12,104 km	5,832.00 Hours	<input checked="" type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Gas	24 kg
 EARTH	15 °Celsius	12,756 km	24.00 Hours	<input checked="" type="checkbox"/> Solid <input checked="" type="checkbox"/> Liquid <input type="checkbox"/> Gas	26 kg
 MARS	-63 °Celsius	6,792 km	24.66 Hours	<input checked="" type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Gas	10 kg
 JUPITER	-108 °Celsius	142,984 km	9.93 Hours	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Gas	66 kg
 SATURN	-139 °Celsius	120,536 km	10.66 Hours	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Gas	28 kg
 URANUS	-197 °Celsius	51,118 km	17.24 Hours	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Gas	24 kg
 NEPTUNE	-201 °Celsius	49,528 km	16.11 Hours	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Gas	30 kg

# USA: Next Generation Science Standards (NGSS)

## Solar System Expedition: NGSS Standards Alignment

### K – 2<sup>nd</sup> Grade:

- **K-2-ETS1-1 Engineering Design:** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- **K-2-ETS1-2 Engineering Design:** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- **1-ESS1 Earth's Place in the Universe:** Use observations of the sun, moon, and stars to describe patterns that can be predicted

### Grade 3:

- **3-5-ETS1-1 Engineering Design:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2 Engineering Design:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

### Grade 4:

- **3-5-ETS1-1 Engineering Design:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2 Engineering Design:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

### Grade 5:

- **3-5-ETS1-1 Engineering Design:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2 Engineering Design:** Generate and compare multiple possible solutions to a problem based on how well each is likely

### Middle School (6-8)

- **MS-ESS1-3 Earth's Place in the Universe:** Analyze and interpret data to determine scale properties of objects in the solar system.
- **MS-ETS1-1 Engineering Design:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2 Engineering Design:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3 Engineering Design:** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success

# TEXAS: TEKS Curriculum Standards

## Solar System Expedition: Elementary School TEKS Alignment

### Grade 1:

- **112.12 (2) Scientific Investigation & Reasoning:** (a) Collecting data and making simple observations, (c) record and organize data, (e) communicate observations
- **112.12 (4) Scientific Investigation & Reasoning:** (a) collect, record, and compare information using tools, including computers, primary balances, notebooks, timers, thermometers.
- **112.12 (5) Matter & Energy:** (a) classify objects by observable properties such as larger and smaller, heavier and lighter

### Grade 2:

- **112.13 (2) Scientific Investigation & Reasoning:** (a) collect data from observations using balances, thermometers,, (d) record and organize data using pictures, numbers, and words, (e) communicate observations
- **112.13 (3) Scientific Investigation & Reasoning:** (a) identify and explain a problem and propose a solution.
- **112.13 (4) Scientific Investigation & Reasoning:** (a) collect, record, and compare information using tools, including computers, rulers, primary balances, notebooks,; timing devices, including stopwatches; weather instruments such as thermometers
- **112.13 (5) Matter & Energy:** (a) classify matter by physical properties, including relative mass, relative temperature, and whether material is a solid or liquid;

### Grade 3:

- **112.14 (2): Scientific Investigation & Reasoning:** (a) Using equipment to solve problems, (b) collecting data, (c) graphing data, (d) analyze data, (f) communicate conclusion
- **112.14 (4): Scientific Investigation & Reasoning:** (a) Collect, record, analyze data using cameras, computers, metric rulers, thermometers, Sun, Earth, Moon system models, timing devices
- **112.14 (5): Matter & Energy:** (a) measure, test, and record physical properties of matter, including temperature, mass, [b] classify matter
- **112.14 (8): Earth & Space:** [d] Identify planets in the Solar System
- **112.14 (9): Organisms & Environment:** Observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem;

### Grade 4:

- **112.15 (2): Scientific Investigation & Reasoning:** (b) collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing. (c) construct simple tables, charts, bar graphs. (d) analyze data and interpret patterns. (f) communicate valid results supported by data.
- **112.15 (4): Scientific Investigation & Reasoning** Collect, record, analyze data using cameras, computers, metric rulers, thermometers, Sun, Earth, Moon system models, timing devices
- **112.15 (5): Matter & Energy:** (a)measure, compare, and contrast physical properties of matter, including size, mass, volume, states (solid, liquid, gas), temperature,

### Grade 5:

- **112.16 (2): Scientific Investigation & Reasoning:** (c) Collect information by detailed observations and accurate measuring. (g) construct appropriate simple graphs, tables to organize, examine, and evaluate information.
- **112.16 (4): Scientific Investigation & Reasoning:** (a) Collect, record, analyze data using cameras, computers, metric rulers, thermometers, Sun, Earth, Moon system models, timing devices
- **112.16 (5): Matter & Energy:** (a) classify matter based on physical properties, including mass and physical state (solid, liquid, and gas).
- **112.16 (8): Earth & Space:** [d] identify and compare the physical characteristics of the Sun, Earth.

# FLORIDA: Next Generation Sunshine State Standards (NGSSS)

## Solar System Expedition: NGSSS Standards Alignment

### Grade 2:

- **Physical Science: Properties of Matter**
  - 2.P.8.1: Observe and measure objects in terms of their properties, including size, shape, color, temperature, weight, texture, sinking or floating in water, and attraction and repulsion of magnets.
  - 2.P.8.2: Identify objects and materials as solid, liquid, or gas.
- **Nature of Science: The Practice of Science**
  - 2.N.1.1: Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.

### Grade 3:

- **Physical Science: Properties of Matter**
  - 3.P.8.1: Measure and compare temperatures of various samples of solids and liquids.
  - 3.P.8.3: Compare materials and objects according to properties such as size, shape, color, texture, and hardness.
- **Nature of Science: The Practice of Science**
  - 3.N.1.1: Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.
  - 3.N.1.3: Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

### Grade 5:

- **Physical Science: Properties of Matter:**
  - 5.P.8.1: Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.
- **Earth and Space Science: Earth in Space and Time**
  - SC.5.E.5.2: Recognize the major common characteristics of all planets and compare/contrast the properties of inner and outer planets.
- **Nature of Science: The Practice of Science**
  - 5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

### Grade 8:

- **Earth and Space Science: Earth in Space and Time**
  - 8.E.5.3: Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.

**Print and Distribute Copies of the Following  
4 Pages to Each Student or Group of  
Students Using This Lesson**

- **Pre-Mission Questions**
- **Exploration Notes**
- **Post-Mission Questions**
- **Base Design Page**



# PRE-MISSION QUESTIONS

**TOP SECRET**

Answer each of the following questions, if you can.  
If you don't know an answer, simply leave it blank

1) WHICH PLANET IS CLOSEST TO THE SUN?

2) WHICH PLANET HAS THE MOST GRAVITY?

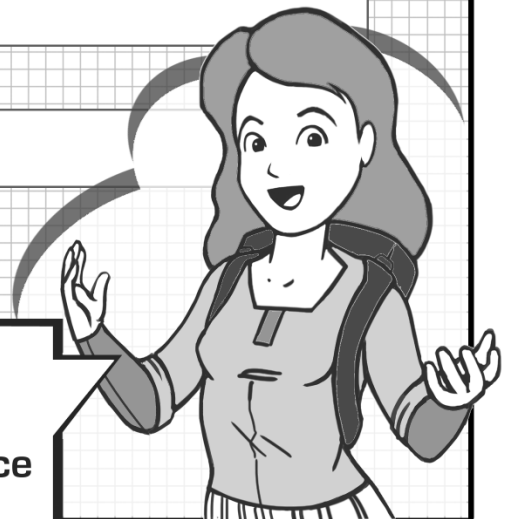
3) WHICH FOUR PLANETS HAVE A SOLID SURFACE?

4) WHICH PLANET IS TILTED SIDEWAYS RELATIVE TO THE OTHER PLANETS?

5) WHICH PLANET HAS THE HIGHEST AVERAGE SURFACE TEMPERATURE?

6) WHICH PLANET HAS THE GREATEST DIAMETER (WIDTH)?

7) WHICH PLANET HAS THE LONGEST DAY?



To prepare for this exciting journey  
We need to ask a few basic questions  
These will measure your knowledge of space  
Just follow these simple directions












































Use this sheet to take notes as you go  
 Record data from each page of this book  
 We've completed the first entry for you  
 To show how your answers should look

**TOP SECRET**

# EXPLORATION NOTES

Record Your Observations of Each Planet

	 TEMPERATURE	 WIDTH (Diameter)	 LENGTH OF DAY	 SURFACE TYPE (Circle One)	 GRAVITY (26 kg on Earth = ?)
 SUN	5,600 °Celsius	1,392,684 km	610.80 Hours	  <input checked="" type="radio"/> 	726 kg
 MERCURY	°Celsius	km	Hours	  	kg
 VENUS	°Celsius	km	Hours	  	kg
 EARTH	°Celsius	km	Hours	  	kg
 MARS	°Celsius	km	Hours	  	kg
 JUPITER	°Celsius	km	Hours	  	kg
 SATURN	°Celsius	km	Hours	  	kg
 URANUS	°Celsius	km	Hours	  	kg
 NEPTUNE	°Celsius	km	Hours	  	kg

# POST-MISSION QUESTIONS

**TOP SECRET**

Refer to your notes and answer each question

1) WHICH PLANET IS CLOSEST TO THE SUN?

2) WHICH PLANET HAS THE MOST GRAVITY?

3) WHICH FOUR PLANETS HAVE A SOLID SURFACE?

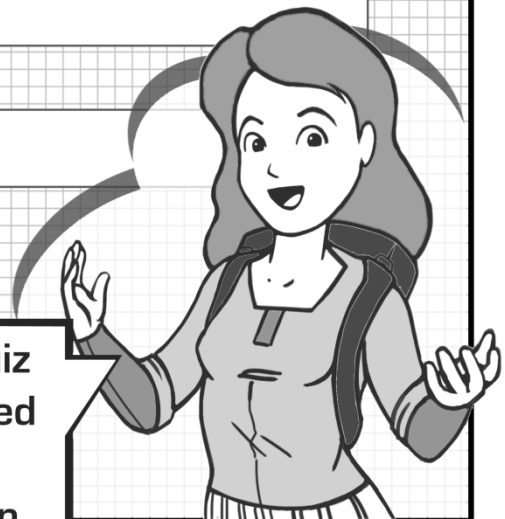
4) WHICH PLANET IS TILTED SIDEWAYS RELATIVE TO THE OTHER PLANETS?

5) WHICH PLANET HAS THE HIGHEST AVERAGE SURFACE TEMPERATURE?

6) WHICH PLANET HAS THE GREATEST DIAMETER (WIDTH)?

7) WHICH PLANET HAS THE LONGEST DAY?

Alright, it's time to retake the quiz  
To see how much you have learned  
Refer to the notes that you took  
And answer each question in turn



As you sketch your design for the base  
Look at your notes from before  
And design your base so it can handle  
Your planet's challenges, dangers, and more



## CENTRAL COMPUTER



### **BASE DESIGN**

DRAW YOUR BASE BELOW

YOUR NAME: \_\_\_\_\_

PLANET NAME: \_\_\_\_\_

A large, empty rectangular area with a thin border, intended for drawing the base design. It occupies the majority of the lower half of the page.