LESSON PLAN

Space

Teacher Notes:

Next Generation Sunshine State Standards:

SC.4.E.5.3-- Recognize that Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day.
SC.4.E.5.4-- Relate that the rotation of Earth (day and night) and apparent movements of the Sun, Moon, and stars are connected.
SC.4.E.5.In.c-- Recognize that Earth revolves around the Sun.
SC.4.E.5.In.e-- Identify objects and people related to the space program in Florida.
SC.4.E.5.Su.c-- Recognize that Earth is always turning (rotating).
SC.4.E.5.Su.e-- Recognize an object or person related to the space program in Florida.
SC.4.E.5.Pa.d-- Recognize a space-related object.

SC.6.P.13.2-- Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

SC.8.E.5.1-- Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.
SC.8.E.5.4-- Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.
SC.8.E.5.7-- Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.
SC.8.E.5.8-- Compare various historical models of the Solar System, including geocentric and heliocentric.
SC.8.E.5.12-- Summarize the effects of space exploration on the economy and culture of Florida.
SC.8.E.5.In.a-- Compare the distances of the Moon, the Sun, and other stars from the Earth.
SC.8.E.5.In.d-- Identify gravity as the force that holds orbiting planets in place in the Solar System.
SC.8.E.5.In.g-- Compare conditions on other planets in the Solar System to those on Earth, such as gravity, temperature, and atmosphere.
SC.8.E.5.In.h-- Identify that long ago people thought the Sun traveled around Earth (geocentric model) until scientists proved otherwise.
SC.8.E.5.In.k-- Identify technology used by scientists to locate, view, and study objects in space.
SC.8.E.5.In.m-- Identify effects of space research and exploration on Florida's economy.

SC.8.E.5.Su.c-- Identify that there are planets and moons in the Solar System.
SC.8.E.5.Su.h-- Recognize that scientists use special tools to examine objects in space.
SC.8.E.5.Su.i-- Identify an effect space exploration has had on Florida's economy.
SC.8.E.5.Pa.d-- Recognize a technology tool created for space exploration and adapted for personal use, such as computers, telescopes, or satellites.

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SC.912.P.12.9-- Recognize that time, length, and energy depend on the frame of reference.

SC.912.E.5.6-- Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.
SC.912.E.5.7-- Relate the history of and explain the justification for future space exploration and continuing technology development.
SC.912.E.5.9-- Analyze the broad effects of space exploration on the economy and culture of Florida.
SC.912.E.5.11-- Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.

Common Core Literacy Standards:

CCSS.ELA-Literacy.RST.6-8.1-- Cite specific textual evidence to support analysis of science and technical texts.
CCSS.ELA-Literacy.RST.6-8.2-- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
CCSS.ELA-Literacy.RST.6-8.3-- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
CCSS.ELA-Literacy.RST.6-8.4-- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics*.
CCSS.ELA-Literacy.RST.6-8.7-- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
CCSS.ELA-Literacy.RST.6-8.8-- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
CCSS.ELA-Literacy.RST.6-8.9-- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

CCSS.ELA-Literacy.RST.9-10.1-- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CCSS.ELA-Literacy.RST.9-10.3-- Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.RST.9-10.4-- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.
CCSS.ELA-Literacy.RST.9-10.8-- Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

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CCSS.ELA-Literacy.RST.11-12.3-- Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.4-- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.
CCSS.ELA-Literacy.RST.11-12.7-- Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
CCSS.ELA-Literacy.RST.11-12.8-- Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
CCSS.ELA-Literacy.RST.11-12.9-- Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Common Core Mathematics Standards:

CCSS.Math.Content.4.MD.A.1-- Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*
CCSS.Math.Content.4.MD.A.2-- Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

CCSS.Math.Content.5.MD.A.1-- Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

CCSS.Math.Content.6.EE.C.9-- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the
independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant

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speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.

CCSS.Math.Content.7.EE.A.1-- Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

CCSS.Math.Content.7.EE.A.2-- Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*
CCSS.Math.Content.7.SP.C.7-- Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
CCSS.Math.Content.7.RP.A.2b-- Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

CCSS.Math.Content.8.EE.A.4-- Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology

CCSS.Math.Content.HSA-CED.A.1-- Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*.
CCSS.Math.Content.HSA-CED.A.2-- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
CCSS.Math.Content.HSN-Q.A.1-- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
CCSS.Math.Content.HSN-Q.A.2-- Define appropriate quantities for the purpose of descriptive modeling.
CCSS.Math.Content.HSN-Q.A.3-- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CCSS.Math.Content.HSS-IC.A.2-- Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*?
CCSS.Math.Content.HSS-IC.B.5-- Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
CCSS.Math.Content.HSS-IC.B.6-- Evaluate reports based on data.

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Timing:

Approximately 30-45 minutes of data collection at ***WonderWorks***.

Target Classes:

- Elementary School – Earth & Space Science, specially 4th grade
- Middle School – Physical Science & Earth in Space & Time, specially 8th grade
- High School – Physical Science (Motion) & Earth and Space Science

Summary of the Activity:

The following activity introduces Kepler's law of Planetary Motion, Newton's Laws, space exploration and looking at the different calendar days between Mars and Earth. The worksheet has students visit the space shuttle scale, space trivia, cosmic trivia and Kepler's planetary motion exhibit.

Pre- Field Trip Activities:

Spend 1-2 days covering Space on which we plan to focus

- Pre-assessment (formal or informal) to gauge students' knowledge
- Give an overview of relevant vocabulary
- Predict your weight on Earth, Mars, and the Moon.
    - Explain (verbally or written) why you chose your predictions.
- Discuss the NASA and space program in Florida.
- Discuss *Kepler's Law of Planetary Motion* and *Newton's Laws* in relation to Earth, Moon, and Sun.

Variations of the lesson include:

- For ESE/ESOL students:
    - Deliberate grouping of ESE/ESOL students with standard students/chaperones
    - Go over directions of each exhibit before field trip with ESE/ESOL students

WonderWorks Activity: Please print the Space Lesson Scavenger Hunt file.

WONDERWORKS
LET YOUR IMAGINATION RUN WILD !

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Post-Field Trip Activities:

- How much would you and the space suit weigh on the Moon and Mars?

- Discuss and define planetary motion, gravity, and Kepler (the scientist, not the law).
  - Write how all 3 are tied together.

- Discuss what constitutes a year on Mercury.
  - Based on the data and evidence presented write how it is possible that Mercury's years are shorter than its days?

- Based on your visit to ***WonderWorks***, write a short essay on why it is important that we continue space exploration (research, mission etc…). Use evidence to support your answer. Uses facts, examples, and/or current events etc…