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| **ENGAGEMENT Time: Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **Student Responses and Misconceptions** |
| **Show a volcano erupting from the ground, and then show a volcano erupting from space (ngssphenomena).** | **From each perspective, how does the volcano look different? Does anything actually change size or is it your perspective? Are any planets larger/smaller than the Earth? Can we see them from Earth? Why/why not? Why do we make scale models?**  **Can you create a model of the solar system? Is it to scale? What do we need to create a scale model?** | **You can see all the planets clearly with a telescope.**  **Students will know which planets are larger or smaller than Earth.**  **Students may/may not be able to explain what it means to be a SCALE model.** |
| **Evaluation/Decision Point Assessment** | **Assessment** | **Student Outcomes** |
| **The students will be able to construct a diagram of the orbitals of the planets. (They will also understand that it is not to scale.)** |  | **The students create a diagram of our solar system.** |

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| **EXPLORATION Time: Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **Student Responses and Misconceptions** |
| **The teacher will hand out a chart of the orbital distances (circumference) of the planets. The teacher will discuss with the students what a scale model of the solar system looks like. (Using information from a lesson from NASA’s Project ASTRO.)**  **The teacher informs the students that we will create a model of the inner solar system using the ozobots using a scale that they create.**  **Show video** [**https://www.youtube.com/watch?v=r0KYwbuGjdE**](https://www.youtube.com/watch?v=r0KYwbuGjdE)  **(Animation of orbitals of planets and some satellites.)** | **Could we use a model in the classroom to recreate the solar system? If we can, what would it look like? Where would each planet orbit in the room?**  **Can we create a scale model using the ozobots for every planet?** | **Misconceptions would be that we could fit all nine planets into the classroom with an orbital that would be scale.**  **The students should work down to the fact that the inner planets would be feasible with ozobots.** |
| **Evaluation/Decision Point Assessment** | **Assessment** | **Student Outcomes** |
| **Once the students decide they have enough information to create a ratio to represent the solar system they will use pencil, paper, and calculators to calculate the radius, diameter, and circumference of the planets’ orbits.**  **The students will create a scale model on the paper provided. (They will have to tape paper together to create a layout that is large enough.)** | **The students will create a scale (ratio) proportional to the actual solar system.**  **The students will create a scale model of the inner solar system.** | **The students will have a scale model of the inner planets (the outer planets’ orbits are too large to feasibly fit this activity).** |
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| **EXPLANATION Time: Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **Student Responses and Misconceptions** |
| **The teacher will ask the students to reconstruct their models so that the ozobots will revolve around a central point (Sun) in a time that is proportional to their actual revolution time.** | **Now that we have a scale model of the inner planets and their orbits, are the revolutions of the planets proportional to their actual time frame?**  **If the scale model is accurate, will the time it takes for the ozobots to revolve around our Sun proportional to their actual times?** | **The students will think that the revolutions will be proportional on time just because the orbits are to scale. They will not at first think about the speeds of the planets.** |
| **Evaluation/Decision Point Assessment** | **Assessment** | **Student Outcomes** |
| **Once the students understand that the speed of the planets determine their revolution and not just the distance around the Sun.** | **The students will adjust their ozobot orbitals with codes to simulate the inner planet revolutions around the Sun.** | **The students will have charts and tables made with proportional time frames and their model should reflect their calculations.** |

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| **ELABORATION Time: Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **Student Responses and Misconceptions** |
| **The teacher will introduce the concept of a satellite and its elliptical orbit.** | **Now that you have your scale model that is accurate on distance and timing, let’s add one more item to our model, a satellite?**  **Can you add a comet or satellite that is moving across the paths of the planets without interrupting their revolution? (Refer back to video.)** | **All satellites are manmade objects.**  **A comet’s path is circular.** |
| **Evaluation/Decision Point Assessment** | **Assessment** | **Student Outcomes** |
| **The students can explain what a satellite can be, identify a common satellite, and identify its path through the inner solar system.** | **The students will create a model of the inner solar system with a satellite.** | **The students will add an elliptical orbit to their model that crosses the paths of the planets without interrupting the revolution of the ozobots.** |

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| **EVALUATION Time: Minutes** | | |
| **What the Teacher Will Do** | **Probing/Eliciting Questions** | **Student Responses and Misconceptions** |
|  |  | **The students will have a complete scale model of the inner solar system with satellite. The revolution of the planets will be proportional to their actual timing in orbit around the Sun.** |

**5E Lesson Plan Template**

\*All companion materials such as power points, handouts and video clips must be included with the submitted lesson plan.

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| **Authors:** | Teresa Robertson and Amanda Ray |
| **Title:** | Ozo’s in Space |
| **Grade level(s):** | 7th Grade |
| **Time Required:** | 3 Class Periods (3 hours 30 minutes) |
| **Subject(s):** | Math and Science |
| **Standards:** | 07-PS2-4, 7.RP.1, 7.RP.2, 7.EE.1, 7.EE.3, 7.G.1, 7.G.2, 7.G.4, 7.G.6 |
| **Science and Engineering Practices, Cross-cutting Concepts and Standards for Mathematical Practice** | Asking questions (for science) and defining problems (for engineering), Developing and using models, Planning and carrying out investigations, Analyzing and interpreting data, Using mathematics and computational thinking, Make Sense of Problems and Persevere in Solving Them, Reason Abstractly and Quantitatively, Construct Valuable Arguments and Critique the Reasoning of Others, Model with Mathematics, Use Appropriate Tools Strategically, Attend to Precision |
| **Objectives:** | The students will create a scale model of the inner solar system, using ozobots to represent the planets. |
| **Materials List:** | Ozobots, markers, calculators, giant white paper, tape, stopwatches, meter sticks |
| **Safety Concerns:** | The students must be able to use equipment properly and be able to work from the floor. |
| **Accommodations for Learners with Special Needs (ELL, Special Ed, 504, GT, etc.):** | Group students with higher ability students, assign roles in each group that match with accommodations, give students completed charts or tables. |
| **References:** | Project ASTRO, http://solarsystem.nasa.gov/kids/index.cfm# |