

Interstellar Architect: Designing the Solar System to Scale

Lesson Overview

In this lesson, Wyatt will transition from simply memorizing planet names to understanding the staggering scale of our cosmic neighborhood and the unique physical conditions that define each world. We will move from a conceptual overview to a hands-on scaling activity, concluding with a creative engineering/marketing project.

Learning Objectives

- **Scale & Distance:** Wyatt will demonstrate the relative distances between planets using a scaled model.
- **Categorization:** Wyatt will differentiate between Terrestrial planets, Gas Giants, and Ice Giants based on composition and location.
- **Physical Analysis:** Wyatt will identify unique geological or atmospheric features of three different celestial bodies (planets or moons).
- **Synthesis:** Wyatt will apply planetary data to create a "Travel Prospectus" for a future colony.

Materials Needed

- A long outdoor space (driveway, sidewalk, or park) or a very long hallway.
- A roll of toilet paper (at least 50 sheets) OR a 100-foot measuring tape.
- Small household objects to represent planets (e.g., a peppercorn, a cherry tomato, a large watermelon, a grape).
- Access to NASA's ["Eyes on the Solar System"](#) interactive (Free online tool).
- Notebook, laptop, or poster board for the final project.

1. Introduction: The Hook (10 Minutes)

The Scenario: "Space is big. Really big. You just won't believe how vastly, hugely, mind-bogglingly big it is." (Douglas Adams). If you were traveling at the speed of light—about 186,000 miles per second—it would still take you over eight minutes just to get from the Sun to Earth. To reach Pluto? About five and a half hours. Most maps in textbooks are wrong because they can't fit the distances and the sizes on the same page. Today, we are going to fix that "wrong" map and figure out where we could actually survive if Earth wasn't an option.

Quick Q&A: If you had to leave Earth tomorrow, which planet would you pick? Why? (Wait for Wyatt's response—usually Mars or a moon like Europa). Let's see if that choice holds up after we look at the data.

2. Instruction: "I Do" (15 Minutes)

The Solar System Layout:

- **The Inner Circle (Terrestrial):** Mercury, Venus, Earth, Mars. Small, rocky, dense. They live "close" to the heat.
- **The Asteroid Belt:** The divider. Not a crowded field of rocks like in movies, but a vast ring of debris.
- **The Outer Giants (Jovian):** Jupiter and Saturn (Gas Giants), Uranus and Neptune (Ice Giants). Massive, mostly hydrogen/helium or icy volatiles, no solid surface to stand on.
- **The Kuiper Belt:** The "attic" of the solar system where Pluto and comets hang out.

Success Tip: Focus on the "Snow Line." Inside this line, it's too hot for volatile ices to condense, which is why the inner planets are rocky. Outside this line, it's cold enough for gas giants to grow massive by grabbing ice and gas.

3. Guided Practice: "We Do" (30 Minutes)

Activity: The "Pocket" and "Pavement" Solar System

Step 1 (The Visual): Use a strip of paper or a single roll of toilet paper. If the Sun is at one end and Pluto is at the 50th sheet, where do you think Earth is? (Have Wyatt guess and mark it).

Spoiler: Earth is only about 1.3 sheets away from the Sun. The first four planets are all bunched at the very beginning!

Step 2 (The Walk): Head outside with the objects and the measuring tape. We will use a scale where 1 meter (roughly 1 large step) = 100 million miles.

- **Sun:** Place a large ball/watermelon.
- **Mercury:** 0.4 steps from Sun.
- **Venus:** 0.7 steps from Sun.
- **Earth:** 1 step from Sun (peppercorn).
- **Mars:** 1.5 steps.
- **Jupiter:** 5.2 steps.
- **Saturn:** 9.5 steps.
- **Uranus:** 19 steps.
- **Neptune:** 30 steps.

Discussion: Look back at the "Sun" from Neptune's position. Notice the "emptiness" of the outer solar system compared to the crowded inner neighborhood.

4. Independent Practice: "You Do" (40 Minutes)

The "Galactic Real Estate" Project

The Mission: Wyatt is now a high-end real estate agent for the year 2150. He must choose **one**

celestial body (excluding Earth) and create a "Sales Prospectus" or a "Digital Travel Brochure" to convince people to move there.

Requirements:

- **The Stats:** Distance from the Sun, gravity (compared to Earth), and average temperature.
- **The "Selling Point":** Mention at least one unique feature (e.g., "See the Great Red Spot!" or "Low gravity cliff-jumping on Miranda!").
- **The Challenge:** Identify one major danger of living there (e.g., sulfuric acid rain, extreme radiation, or lack of oxygen) and propose a "high-tech solution" for the settlers.
- **Visual:** A sketch or a digital collage of what the colony might look like.

5. Conclusion & Assessment (15 Minutes)

Recap:

Review the walk we took. Why do we call the outer planets "Giants"? Why can't we stand on Jupiter? How does distance from the Sun affect the "habitability" of a planet?

Summative Assessment:

Wyett will present his Real Estate Prospectus. Success is measured by:

- Accuracy of the planetary data (temp, distance, composition).
- Creativity in the "high-tech solution" for the planet's hazards.
- Clear explanation of why this body is classified as Terrestrial, Gas, or Ice giant/moon.

Differentiation Options:

- **For the Tech-Savvy:** Instead of a paper brochure, use *Minecraft* or *Kerbal Space Program* to build a base on the chosen planet and explain the physics involved.
- **For the Math-Focused:** Calculate how old Wyett would be in "Jupiter Years" or "Mercury Years" (Age / Orbital Period).
- **Scaffolding:** Provide a "Cheat Sheet" of planetary data for Wyett to use during the project so he can focus on the creative application rather than just searching for numbers.

Success Criteria for Wyett:

"I'll know I've nailed this if I can explain to someone why the inner planets are so different from the outer ones, and if I can design a cool way for humans to survive the crazy conditions on another world."