Plan for the day:

1) FINISH/Calculate a different scale so we can see each planet and other celestial objects in our model. (Relative size of sun, planets, asteroid belt and Halley's comet.)

2) POCKET Solar System model using everyone's favorite demoted planet (only because the numbers make it interesting), Pluto!

Disciplinary Core Ideas:

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).

Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.

Name Class Date

Making a scale model takes a bit of planning. That planning requires a lot of math!

One of our 6th grade learning objectives states that students will be able to **"construct models with accurate scale that represent the orbital position of the Earth relative to the sun and to other planets, comets and asteroids."**

After viewing the Khan Academy video about the scale of our solar system, we learned that we can scale the distances between objects in our solar system or we can scale the sizes of objects in our solar system. However, we cannot accurately do both. We decided to scale the distance between objects to meet the learning objective and use a different scale for the size of our sun, planets and other celestial bodies.

Together, we converted the 35 ft. 8 in. length of the science classroom to 1087.1 cm and determined that equaled the 30 Astronomical Units (AU) of distance from the sun to Neptune. (As a refresher, please look at the previous lesson on http://mrsmorin.weebly.com/6th-grade-science.html.)

Planet Name	Distance from the Sun (km)	AU	Distance from "Sun" Wall (cm)
Mercury			
Venus			
Earth	150,000,000	1	36.3
Mars			
Asteroid Belt			
Jupiter			
Saturn			
Uranus			
Neptune	4,497,000,000	30	1087.1

Name Class Date

Now that you have determined the distances from the sun to each of the planets and other important celestial bodies in our solar system, you need to think about how to represent the relative size of the planets. You learned from the Khan Academy video, Scale of the Solar System, that Earth would be microscopic using the limited distance available in our classroom. Therefore, you will not be able to use the same ratios used for distances on the reverse side. However, you will need to make each planet relate to its neighbors in a meaningful way so that everyone can see each planet and how different each is when compared to the other in the solar system.

Brainstorm with your table partners how you will approach this problem (set up the ratios). Remember, objects in your scale model of the solar system must be visible but not interfere with any other table group's model or block any student's ability to see the Smart Board from anywhere in the classroom.

Planet Name	Actual Celestial Object Size (km)	Scaled Down Size (cm)
Mercury		
Venus		
Earth		
Mars		
Asteroid Belt		
Jupiter		
Saturn		
Uranus		
Neptune		
Halley's comet		

Sep 25-6:22 AM

10.87 m (~11 m) solar system Mrs. Morin's classroom

3.5 mile Desert solar system (video)

1 km = ~0.6 mi

$$\frac{1\ km}{0.6\ mi} = \frac{x\ km}{3.5\ mi}$$

$$1\ km \cdot 3.5\ mi = x\ km \cdot 0.6\ mi$$

$$\frac{1\ km \cdot 3.5\ mi}{0.6\ mi} = \frac{x\ km \cdot 0.6\ mi}{0.6\ mi}$$

5.83 km = x km

Desert Model (DM) in km

5.83 km = 5,833 m

$$\frac{11\ m}{5,833} = 0.00188$$

or 0.002

one-two thousandths

How our model compares to the DM

Sep 8-9:12 AM

Last meeting, you started learning about our solar system calculating a scale for this classroom.

Today, you will complete the separate scale for the sun, planets and other celestial bodies (because we do not have the luxury of 3.5 miles!).

Remember, you are attempting to show understanding of the Disciplinary Core Ideas!

Sep 25-6:22 AM

Last class, you worked to complete a table that calculates the scaled distances of each planet from the sun using the 1087.1 cm of space we have for our scale model.

Once you knew those distances, you could then separately determine how to scale and represent each planet along that 1087.1 cm distance.

Oct 3-7:01 AM

This is how you used the information to setup the distances for your model.

1) You used math to set up equations.

2a) You understood the space available representing the distance from the sun to Neptune is 1087.1 cm.

2b) You needed to know the actual distance to Neptune, 4,497,000,000 km.

3) You set up a ratio to compare the distance, wall to wall, to the actual distance of Neptune from the sun.

Oct 3-7:01 AM

This is how you used the information to setup the distances for your model.

From the Astronomy text (page 63) and your Space Science workbook (page 93):

Earth is: **150,000,000 km** from the sun which is **1 Astronomical Unit (AU)**.

Astronomy text (page 71) and your Space Science workbook (page 110): Neptune is about 4,497,000,000 km from the sun or 30 AU.

Oct 3-7:01 AM

Done last class. Complete for HOMEWORK if necessary

Astronomy text: page 63

Astronomy text: page 71

Planet Name	Distance from the Sun (km)	AU	Distance from "Sun" Wall (cm)
Mercury	58,000,000	0.4	14.5
Venus	108,000,000	0.7	25.3
Earth	150,000,000	1	36.2
Mars	228,000,000	1.5	54.3
Asteroid Belt	550,000,000	3.7	133.9
Jupiter	778,000,000	5.2	188.2
Saturn	1,427,000,000	9.5	343.9
Uranus	2,871,000,000	19.1	691.4
Neptune	4,497,000,000	30	1087.1

Oct 2-10:20 AM

NOW, you need to determine the size of each celestial object in our solar system!

(According to what we saw and heard in the video, scaling the distance will need to be separate from scaling the size of the sun and planets because we do not have the space necessary to have only one scale!)

Oct 3-7:01 AM

Using the same reasoning you used to determine the distance from the sun, determine the model size for EACH celestial body listed by making the SUN how many meter(s) in size.

You will calculate these values on your own.

Work cooperatively!

Use the calculators at the end of the student table.

Return the calculators at the end of class.

Name Class Date

Now that you have determined the distances from the sun to each of the planets and other important celestial bodies in our solar system, you need to think about how to represent the relative size of the planets. You learned from the Khan Academy video, Scale of the Solar System, that Earth would be microscopic using the limited distance available in our classroom. Therefore, you will not be able to use the same ratios used for distances on the reverse side. However, you will need to make each planet relate to its neighbors in a meaningful way so that everyone can see each planet and how different each is when compared to the other in the solar system.

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Venus		
Earth		
Mars		
Asteroid Belt		
Jupiter		
Saturn		
Uranus		
Neptune		
Halley's comet		

Use RATIOS like you did for the distances between the celestial objects!

Oct 3-7:01 AM

Hmm... Mrs. Morin seems to have left something off the second table. What could that be?

****

The SUN! Add the sun to the BOTTOM of the table, as you will need to put the sun in your model, the center of our solar system, too!

SUN		

You must also include a comet in your model as comets are significant celestial objects. You will include Halley's comet.

Oct 6-10:53 AM

Jupiter's diameter is 142,800 km 14.3 cm

The sun's diameter is 1,400,000 km 140.0 cm

Jupiter is about 1/10th the size of the sun!

Does anyone notice anything interesting about these two numbers?

Mercury

$$\frac{4{,}878\ \text{km}}{1{,}400{,}000\ \text{km}} = \frac{X\ \text{cm}}{140\ \text{cm}}$$

$$140\ \text{cm}\ (4878\ \text{km}) = 1{,}400{,}000\ \text{km}\ (X\ \text{cm})$$

$$\frac{140\ \text{cm}\ (4878\ \text{km})}{1{,}400{,}000\ \text{km}} = \frac{1{,}400{,}000\ \text{km}\ (X\ \text{cm})}{1{,}400{,}000\ \text{km}}$$

$$\frac{1}{10{,}000} = X\ \text{cm}$$

Actually, a km is 100,000 times larger than a cm (100 cm/m and 1,000m/km). So the scale is even smaller than what we calculate above. BUT, this calculation tells us we can simply move the decimal 4 places to the left and change the units from km to cm.

Oct 6-10:53 AM

INNER

OUTER

ADD

Planet Name	Actual Celestial Object Size (km)	Scaled Down Size (cm)
Mercury	4,878	0.5
Venus	12,104	1.2
Earth	12,756	1.3
Mars	6,794	0.7
Asteroid Belt		
Jupiter	142,800	14.3
Saturn	120,520	12.1
Uranus	51,200	5.1
Neptune	49,500	5.0
Halley's comet		
Sun	1,400,000	140.0

Oct 6-10:59 AM

Each table group will be assigned at least one celestial object to:

1) Provide information that will be hung with the model.

2) Make a two dimensional representation of your assigned celestial object(s) to hang on the solar system for your class.

3) All students will complete page 2 so you know what size to make all the celestial object should be in the class' model.

Oct 6-6:50 AM

All Tables Groups: Information MUST include Period of rotation and revolution!

Table 1 - SUN: 10 facts total (you have lots of space)

Five (5) facts for each celestial body below:

Table 2 - Mercury and Venus

Table 3 - Earth and Mars

Table 4 - Asteroid belt and Jupiter

Table 5 - Saturn and Uranus

Table 6 - Neptune and Halley's comet

Oct 6-6:50 AM

GOAL for all classes:

Complete the model by the END of our next class meeting (Monday) & (Tuesday)!

No pressure! A day B day

Resources available:

Space Science workbook (yours!) pages 74 -126;

Astronomy text (4-6/table) pages 56 - 83;

Various items at the Student Table (return when done)

Oct 6-6:50 AM

TIME PERMITTING: The Pocket Solar System:

Take a piece of register tape the is as long as your out-stretched arms (demo).

Fold over and crease each end.

Mark one end **Pluto/Kuiper Belt**; mark the other **SUN**.

Fold the tape in half; make a crease at the fold and make a mark at the crease.

Which planet do you think is halfway between the Sun and Pluto's average orbit?

Sep 8-6:21 AM

TIME PERMITTING: The Pocket Solar System:

Hold the Sun at your head. Which body part matches the crease in your paper?

Mark the crease URANUS!

Now fold the tape in half and in half again.

Make a crease there. Now unfold it.

You have 4 quarters, sun at one end, Pluto at the other and Uranus in the middle.

Hold the Pluto end and label the fold closest to Pluto, NEPTUNE.

Sep 8-6:21 AM

TIME PERMITTING: The Pocket Solar System:

Label the other fold, closest to the sun, Saturn.

What so the first letters of these last three planets spell? SUN.

You have now filled in 3/4ths of the solar system and you still don't have all the Gas Giants!

Fold the Sun to Saturn's orbit and crease it.

What's the next planet in? JUPITER!

Sep 8-6:21 AM

TIME PERMITTING: The Pocket Solar System:

Fold the SUN to meet Jupiter's orbit.

What structure in just inside Jupiter's orbit?

The Asteroid Belt (AB) [redacted]

Now things are about to get crowded and it will be difficult to get precise distances.

Fold the Sun to the Asteroid Belt and crease it.

Next planet in? MARS!

How many more planet orbits?

Sep 8-6:21 AM

TIME PERMITTING: The Pocket Solar System:

Fold the SUN to the orbit of MARS and leave it folded!

Fold that section AGAIN, crease, then unfold the tape.

You should have three (3) creases.

Mark the one closest to Mars, EARTH, the Venus and then Mercury closest to the SUN.

Stretch out your model and take a good look!

What do you notice?

Sep 8-6:21 AM

Attachments

- Scale of Earth and Sun.mp4
- Scale of Solar System.mp4