Plan for the day:

1) Continue planning our classroom scale model of the solar system (finish calculating each celestial object's distance from the sun.)

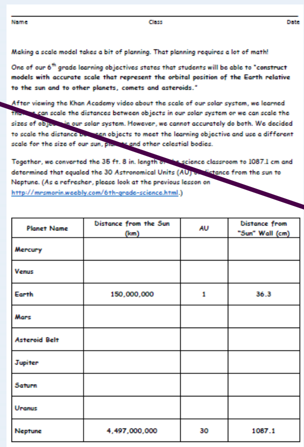
2) Calculate a different scale so we can see each planet and other celestial objects in our model. (Relative size of sun, planets, asteroid belt and Halley's comet.)

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

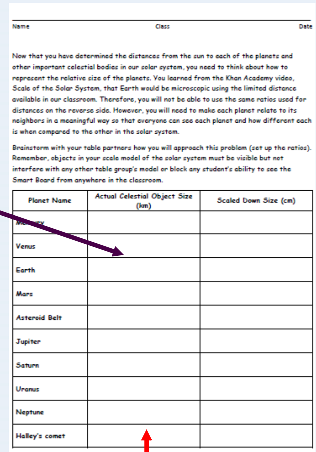
Making a scale model takes a bit of planning. That planning requires a lot of math!

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) or 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

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

Today, you will complete that table and then create a 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 in kilometers (km). 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

78A

Earth

$$\frac{1 \text{ A.U.}}{150{,}000{,}000 \text{ k}} = \frac{x \text{ A.U.}}{4{,}497{,}000{,}000 \text{ Km}}$$

Neptune

Sep 6-10:22 AM

36A

Earth $\frac{1 \text{ A.U.}}{150{,}000{,}000 \text{ k}} = \frac{X \text{ A.U.}}{4{,}494{,}000{,}000 \text{ km}}$ Neptune

$$\frac{1 \text{ AU} \cdot 4{,}497{,}000{,}000 \text{ km}}{150{,}000{,}000 \text{ km}} = \frac{X \text{ AU} \cdot 150{,}000{,}000 \text{ km}}{150{,}000{,}000 \text{ km}}$$

~~29.98~~ 30 = X AU

30 = X AU

Sep 6-7:51 AM

78A

1 AU = 150,000,000 km = X cm in class

30 AU = 4,497,000,000 km = 1087.1 cm

Sep 6-10:24 AM

36A

1 AU = 150,000,000 km = X cm in class

30 AU = 4,497,000,000 km = 1087.1 cm

$$\frac{1\,AU}{X\,cm} \quad \frac{30\,AU}{1087.1\,cm}$$

$$\left[\frac{1\,AU \cdot 1087.1\,cm}{30\,AU} = \frac{X\,cm \cdot 30\,AU}{30\,AU}\right]$$

$$36.2 = X\,cm$$

Sep 6-10:24 AM

12A

1 AU = 150,000,000 km = X cm in class

30 AU = 4,497,000,000 km = 1087.1 cm

$$\frac{1\,A.U}{X\,cm} = \frac{30\,A.U}{1087.1\,cm}$$

$$\frac{1\,A.U \cdot 1087.1\,cm}{30\,A.U} = \frac{30\,A.U \cdot X\,cm}{30\,A.U}$$

$$36.2\,cm = X$$

Sep 6-8:04 AM

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

$$\frac{1\ AU}{150{,}000{,}000} = \frac{x\ AU}{4{,}497{,}000{,}000}$$

x = 30 AU

Calculated from an Excel Spreadsheet

	Distance from Sun to Earth	Distance from Sun to Neptune
AU	1	30
	150,000,000	4,497,000,000

Oct 3-7:01 AM

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

$$\frac{30\ AU}{1087.1\ cm} = \frac{1\ AU}{x\ cm}$$

30AU x cm = 1087.1 AU / 30 AU
Xcm = 36.2

Wall to Wall (cm)	AUs
1087.1	30
Distance Sun to Earth (cm.)	
36.2 cm	1

x = 36.2 cm

Distance of Earth to the sun in model

Oct 3-7:01 AM

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

Done last class (some classes ran out of time!)

Astronomy text: page 63

Astronomy text: page 71

Oct 2-10:20 AM

What else do you need to know to make a scale model that accurately represents our solar system?

150.0 cm
1.5 cm
Earth

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.

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.

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Mercury		
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!

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

	Planet Name	Actual Celestial Object Size (km)	Scaled Down Size (cm)
INNER	Mercury	4,878	0.5
	Venus	12,104	1.2
	Earth	12,756	1.3
	Mars	6,794	0.7
	Asteroid Belt		
OUTER	Jupiter	142,800	14.3
	Saturn	120,520	12.1
	Uranus	51,200	5.1
	Neptune	49,500	5.0
ADD	Halley's comet		
ADD	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: 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 (Thursday and Friday)!

No pressure!

Oct 6-6:50 AM

Attachments

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