STEM EARTH SCIENCE

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Chapter 1: Astronomy

Big Question: How do the processes and events in the solar system influence Earth?

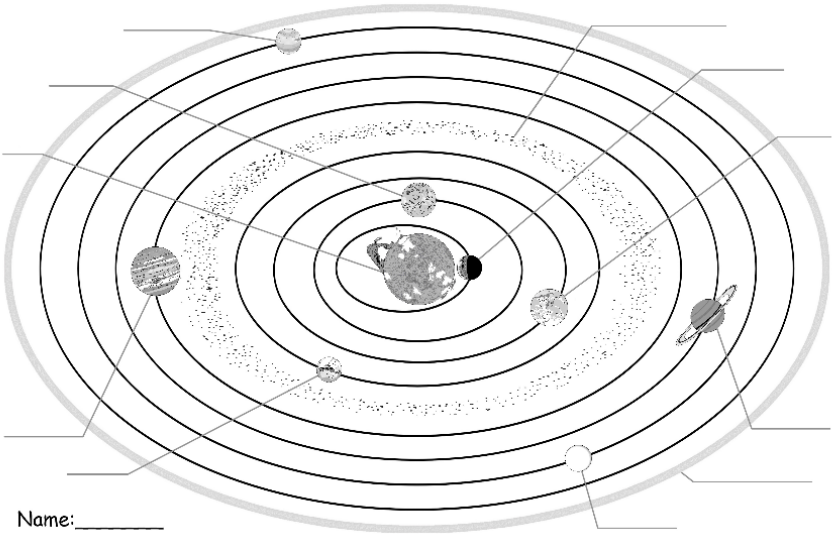
Scenario: NASA plans to construct a solar-powered outpost at one the moon's poles, officials with the U.S. space agency announced. The lunar base is expected to be permanently staffed by 2024. The outpost concept was chosen over a competing strategy similar to the 1960s and '70s Apollo program—a series of brief trips to the moon. "What we're looking at is polar locations—both the North Pole and South Pole," NASA said. The moon's poles are believed to be bathed in near constant sunlight, which should allow for solar power generation. In addition, polar temperatures are relatively moderate. Furthermore, the poles contain craters whose slopes may be permanently in the shadows—an indication that water ice and other potentially useful chemicals may be available. The potential site is about the size of the Washington Mall, which measures about 0.9 square mile (2.4 square kilometers).

Chapter Challenge: Your class will be studying space and the effects that the Sun and other objects in the solar system can have on Earth. Your challenge is to design and carry out an experiment to test the feasibility of using solar panel to run your space station. Some things to consider are; How many panels will we need? How does the distance from the Sun affect the efficiency of the panels? How can you store energy for use during times with no sunlight?

Activities We Did	Patterns or observations/What happened	What do you think caused these patterns or observations?	How do these patterns help us answer our Big Question?
Section 1			
Section 3			
Section 2			

Activities We Did	Patterns or observations/What happened	What do you think caused these patterns or observations?	How do these patterns help us answer our Big Question?
Section 4			
Section 5			
Section 8			
Section 9			

Section 1: The Size and Scale of the Universe



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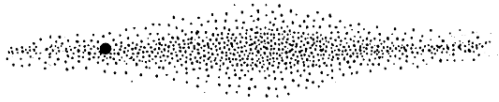
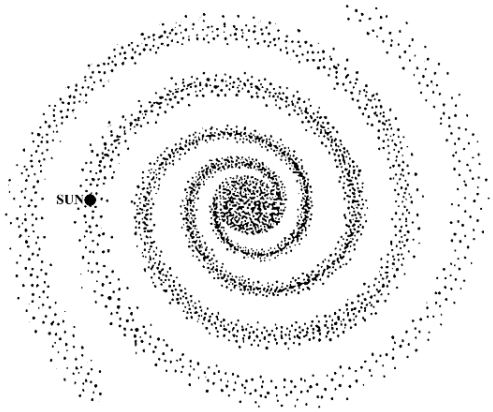
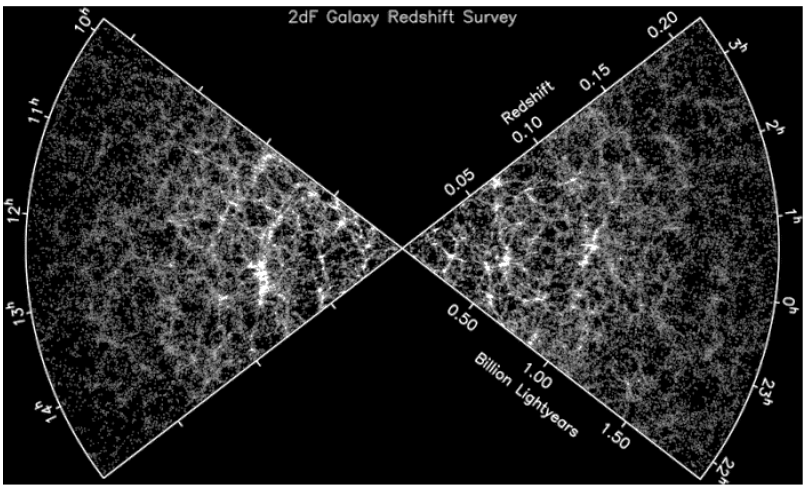


SIDE VIEW



TOP VIEW



Section 1 Question: How can an understanding of size and scale be used to create a model of the solar system?

What do you See?
(Picture)

What do you think?

Which of the following pairs of objects would make a good scale model of Earth and the Moon?

a) a basketball and a soccer ball

b) a basketball and a baseball (or softball)

c) a basketball and a ping-pong ball

d) a basketball and a pea

e) a basketball and a grain of sand

What do you think now?

Focus Question A: What are the components of creating an accurate model?
Observations:
Explanation:

Focus Question B: How do scientists use mathematics to create an accurate model?

Prediction:

Data:

Table 1: Diameters of the Sun and Planets and Distances from the Sun

Object	Distance from Sun (km)	Diameter (km)
Sun	----	1,392,000
Mercury	57,900,000	4,879
Venus	108,200,000	12,104
Earth	149,597,890	12,756
Mars	227,900,000	6,794
Jupiter	778,400,000	142,984
Saturn	1,426,700,000	120,536
Uranus	2,871,000,000	51,118
Neptune	4,489,300,000	49,528

Calculations:

SCALE:_____
__

Table 2: Model Diameters of the Sun and Planets and Model Distances from the Sun		
Object	Distance from Sun (m)	Diameter (m)
Sun		
Mercury		
Venus		
Earth		
Mars		
Jupiter		
Saturn		
Uranus		
Neptune		

Looking at your numbers, what are the advantages and disadvantages of using this scale to create a model of the solar system?

Advantages	Disadvantages

Calculations:

SCALE:_____
__

Table 3: Model Diameters of the Sun and Planets and Model Distances from the Sun		
Object	Distance from Sun (m)	Diameter (m)
Sun		
Mercury		
Venus		
Earth		
Mars		
Jupiter		
Saturn		
Uranus		
Neptune		

Looking at your numbers, what are the advantages and disadvantages of using this scale to create a model of the solar system?

Advantages	Disadvantages

Focus Question D: How can other distance units be used in astronomy?

AU (astronomical unit) = distance between the Earth and the Sun

1 AU = _____ km

1 light-year = _____ AU

Data:

Table 4: Diameters of the Sun and Planets and Distances from the Sun

Object	Distance from Sun (m)	Distance from Sun (AU)
Sun	----	
Mercury	57,900,000	
Venus	108,200,000	
Earth	149,597,890	
Mars	227,900,000	
Jupiter	778,400,000	
Saturn	1,426,700,000	
Uranus	2,871,000,000	
Neptune	4,489,300,000	

Reference Table – Solar System Data

I notice……

I wonder…….

Explanation:

Focus Question E: What factors need to be considered to create an accurate class model of the solar system?

Calculations:

SCALE CHOSEN:_____

Data:

Table 5: Diameters of the Sun and Planets and Distances from the Sun

Object	Distance from Sun (m)	Diameter (m)
Sun	----	
Mercury		
Venus		
Earth		
Mars		
Jupiter		
Saturn		
Uranus		
Neptune		

Observations:
Explanation:

RETURN TO WDYTN

Extension: What characteristics of galaxies are used to classify them?
Predictions:
Observations:
Claim:
Evidence:

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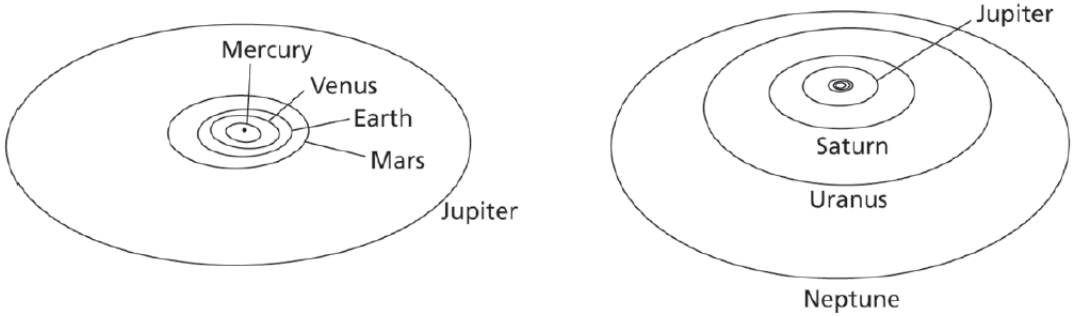
DIGGING DEEPER

Structure of the Solar System

Inner Planets: • Mercury, Venus, Earth, and Mars. • Small, dense, rocky, with iron cores Outer Planets: • Jupiter, Saturn, Uranus, and Neptune • Large, less dense, made of hydrogen, helium, methane, and ammonia. Light takes 8 minutes to travel from the Sun's surface to Earth	In your own words, describe the structure of the solar system In what part of the solar system are asteroids found? In what part of the solar system do comets originate from?



Hubble Tuning Fork and Galaxy Classification

Galaxies are classified by their shape. 1. Spiral 2. Elliptical 3. Irregular There are billions of galaxies in the universe. The Andromeda is the closest to us at 2.9 million light-years.	Recreate the Hubble tuning fork in the space provided. Name and describe the components of a spiral galaxy? 1. 2.

Solar System Data

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm^3)
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 50 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,426.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,118	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	49,528	17.15	1.8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 d	27.3 d	0.055	3,476	0.01	3.3

Page 15 in the E.S.R.T.

Chapter 1, Section 1 E.B.C. Name:_____

Size and Scale of the Universe Period:_____

Question (2)		
Claim 1 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Claim 2 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Analysis (6)		

	Claim *A statement or conclusion that answers the original question/problem.*	**Evidence** *Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.*	**Analysis** *A justification that connects the evidence to the claims. It shows why the data counts as evidence by using appropriate and sufficient scientific principles and vocabulary*.
0	Does not make a claim, or makes an inaccurate claim.	Does not provide evidence, or only provides inaccurate or vague evidence.	Does not provide an analysis, or only provides an irrelevant analysis.
1	Makes an accurate but vague or incomplete claim.	Provides vague evidence and does not include specific data.	Repeats evidence and links it to claim, but does not include specific scientific principles.
2	Makes accurate and complete claim.	Provides correct evidence but does not include specific data.	Connects all evidence to the claims using scientific principles or vocabulary but not both.
3		Provides correct evidence and includes specific data.	Connects all evidence to both claims using scientific principles and vocabulary.

CHECKING UP: Page 16, 1 through 3 (2 points each)

____
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1.

2. A)

   B)

   C)

3.

Using the scale 1m = 3,000,000 km you used for distance in your model of the solar system, answer the following:

a) How far away would Proxima Centauri be from Earth? (5 points)

b) How far away from Earth would the Andromeda Galaxy be on your scale, given that Andromeda is 890 kiloparsecs or 2.9 million light-years away? (5 points)