Modeling Orbits in the Solar System - Human Solar System

1. You will need a long distance area like a hallway (or go outside) to do this activity.

An astronomical unit or AU is the distance between the sun and the earth, 93,003,000 miles. We will work together to make a model to show the relative distances between the planets.

Can anyone tell me what planets are between the Earth and the Sun?

So if Mercury and Venus are between the Earth and Sun, will the distance between them and the sun be more or less than on AU?

Have the children guess the number of AUs between the sun and other planets.

2. Assign each child one of the following planetary body: sun, Mercury, Venus, Earth, Mars, Asteroid belt, Jupiter, Saturn, Uranus Neptune, and Pluto. To measure distance 1 AU will equal 4 steps. Using the "planetary distance guide" help the girls figure out how many steps away from the sun each planet and the asteroid belt should be from the sun. Encourage the children to try and figure out how many steps they will need to take from the sun. If you are inside you may run out of room before you get all nine planets in place. If there are more than 11 children you can add children in the following ways: Two or three children can hold hands in a circle around Saturn for the rings. More children as asteroids. Girls to be moons for all the planets except Mercury and Venus. Cluster a several children together to be a larger sun. Younger children may not be able to do the math, so just tell them the number of steps to take.

I need the sun to stand right here beside me. Now Mercury stand right next to the sun. You are going to take two steps away from the sun. Take short steps, about 12 inches long.

Next I need Venus. You will be taking 3 steps from sun. If Mercury is 2 steps from the sun and Venus is three, how far apart are Venus and Mercury? 3-2=1

Repeat for each planet and the asteroid belt.

3. Once you have all the planets in place start with sun and have everyone walk to Pluto.

Planetary Distance Guide

Planet	AU	Steps	Steps between the planets
Sun	0.0	0	
Mercury	0.4	2	
Venus	0.7	3	1
Earth	1.0	4	1
Mars	1.5	6	2
Asteroid Belt	2.8	11	5
Jupiter	5.0	20	9
Saturn	10.0	40	20
Uranus	19.0	76	36
Neptune	30.0	120	44
Pluto	39.0	156	36

Modeling Planet Sizes

Supplies
large melon (like a honeydew or small watermelon), apple, orange, large and small grapes, dried bean, popcorn seed (you can make substations with similar sized objects. ie. hulled sunflower seed for the popcorn seed.)

1. Do you know which planet the largest in our solar system? Jupiter

How about the smallest? Most people will say Pluto, but with Pluto now being classified as a dwarf planet, some may say Mercury. Today we are including the dwarf planet Pluto, so it is the smallest.

2. I have some different fruits and seeds here. Which one do you think would be Jupiter? What about Pluto? Our challenge is to try and line the fruits and seeds up in size order that matches the planets. We don't have a sun because that would take a very large pumpkin to be the right size to go with our other food items.

3. Let the girls try to figure out the order for the planets.

Mercury - dried bean
Venus - large grape
Earth - large grape
Mars - small grape
Jupiter - large melon
Saturn - lightly smaller melon
Uranus - large apple or orange
Neptune - slightly smaller apple or orange
Pluto - popcorn seed

Planets in size order from largest to smallest: Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury, Pluto

Solar Cookies

Sugar cookies (1 per girl), white frosting (1 can will make 30-40 cookies), red sugar, yellow sugar, mini chocolate chips, plastic knives, small paper plates, Twizlers Peel & Pull, pictures of the sun.

Supplies for each child

1 cookie on a plate
1 strip of a Twizler peel and pull

for each table

2 plates with frosting on it
4-6 plastic knives
1 red sugar
1 yellow sugar
1 plate with mini chocolate chips

1. Have work at tables, with 8-10 at a table. Have children wash their hands. Hand out cookies and other supplies.

We are going to make an edible model of the sun or a Solar Cookie. Can anyone tell me something about the sun?

Does anyone remember safety rules about the sun? Never look at it. Wear sunscreen or protective clothing to protect from burns.

The sun is made up of 4 main parts, the Solar Core which is our cookie. Next is the Photosphere, to show that you will frost your cookie and sprinkle it with red and yellow sugar. Take a look at the picture of the sun, notice how the photo sphere looks like red and yellow dots. Next is the Corona, that is the light that is around the sun, we can't show that with our model. The last part are the solar Prominences. Some people call them solar flares. This is when a bit of the photosphere erupts like a geyser or fountain and shoots off the sun's surface and then falls back down. We will use the Twizler Peel and Pull to make solar prominences.

Sometime the sun also has what are know as sun spots, or darker spots on the surface of the photosphere. Sunspots are cooler areas on the sun's surface. You can use a few mini chocolate chips to make dark spots if you want to.

When you are done making your cookie, show it to the others at your table. No two cookies will be exactly alike. Just like the sun never looks exactly the same when scientists look at it.

Make a Comet Model and Eat It

Supplies

sandwich size re-closable plastic bags	gallon size re-closable plastic bags
small cups	plastic spoons
ice	can opener
whole milk	sugar
vanilla extract	evaporated milk
mittens or gloves (optional)	old towels (for quick cleanups)
measuring cup	measuring spoons
salt	paper and pencil

chunky cookies of any kind, crushed candies, coconut flakes, and peanuts

1. Have children wash hands. Ask about any allergies to milk, chocolate, and or peanuts.
Comets have sometimes been described as dirty snowballs, snowy dirt balls or something in-between. Comets are believed to be a cold mixture of frozen water, dry ice, and other sandy/rocky materials left over from the early formation of our solar system.
2. Divide the children into groups of 2-4. For each group you will need the following.

1/3 c. evaporated milk	2/3 c. whole milk
5 spoonfuls of crushed cookie	5 tsp. of sugar
2 spoonfuls of coconut flakes	2 spoonfuls of “rock material”
1/4 tsp. vanilla extract	ice-enough to fill a gallon bag 3/4 full (2-3 pounds)
sandwich bag	gallon bag
cups-the number of girls plus 1	for each team
spoons-one for each	mittens or gloves

Comet connection: Add ingredients to the ice cream to represent dust (crushed cookies -like Oreo- in fine and large chunks) rocks (peanuts, crushed candies like MM’s, toffee, peppermints), Dry Ice/ carbon dioxide (coconut flakes).

3. Measure the milk, evaporated milk, vanilla and sugar into a sandwich bag. Let the girls measure out the crushed cookie, coconut flakes, and rocks into their own cups. Remind them they are to add only one type of rock material. Add the ingredients to the sandwich bag. Squeeze any extra air out of the sandwich bag and close it. Be sure it cannot leak! Slowly tilt the bag to check the seal.

4. Place the sandwich bag into the bottom on the gallon bag. Fill gallon bag with ice, add 8-10 spoonfuls of salt. Close the large bag tightly, removing as much air as possible and check for leaks. Shake and roll the bag for approximately 10 minutes to freeze the ice cream. Let the girls start shaking the bag with bare hands so they can feel the temperature change. Then if hands get too cold give the team a pair of mittens to share.

5. When the ice cream feels stiff to the touch take it out of the ice and rinse the inner bag briefly with fresh water to remove any salt.

6. Spoon the ice cream into cups, one for each group member and one extra. Don’t eat the extra cup. Trade the extra cup with another team.

Different scientific instruments take different kinds of data. Pretend your eyes, hands and taste buds are scientific instruments taking data from the “comet” you got from the other team. Take the following “data” and record it on your paper.

*Look at your comet and see what you can observe visually.

*Take the extra cup and have your group feel the contents with your fingers.
*Holding you nose, taste the comet and see what your can taste and feel in your mouth.

*Release your nose and see what you able to taste with your sense of smell added.

*Record what you discovered as you watched the elements in the bag become ice cream.

*Share what you discovered with the other groups. Did you identify all in ingredients in the ice cream.

Hints:
-In winter snow can be used instead of ice.
-Have a mop on hand for drips.
-Remind the children not to toss the bags or bang them against a hard surface or the bag may break.
-You may want to pre measure the milk, evaporated milk, vanilla and sugar into a glass before the groups arrive to save time.
-If the weather is nice do the activity outside.
-If you are really short on time use ready made ice cream and just stir in the “rocks.”

Make a Model Saturn

Supplies
1 - 2 or 2.5 inch styrofoam ball cut in half for each child
(styrofoam cutters can be purchased for under $20)
1 old CD for each child

toothpicks	glue (tacky glue works best)
glitter	paperclips
markers	wet towels or paper towels for clean up

1. Each child will need a styrofoam ball, paper clip, toothpick and a CD.

2. The CD will be Saturn's rings. usually one side of the CD has printing on it. This is the side you will decorate with glitter.

*Try not to get glitter in the center part of the CD, where you will be gluing the styrofoam ball.

*Use your finger to carefully spread glue on the CD in a ring. Do not cover the whole CD with glue! Just make a glue ring. Sprinkle glitter on the ring. Knock the excess glitter onto the paper plate. Continue adding glitter rings to the outer edge.

3. Decorate each half of the styrofoam ball with markers.

4. Break a toothpick in half and put it in one of the styrofoam halves. Make sure the toothpick is stuck into the center. Spread glue on the decorated side of the CD in the center. Pick up the CD and place the styrofoam half with the toothpick in the center of the CD, toothpick sticking through the hole. Now put some glue on the center of the other side of the CD. Push the other styrofoam half onto the toothpick sticking out the hole.

5. Open a paper clip so you have a hook at one end.
Decide which half of Saturn you want to be the top. Since Saturn's axis is tilted 28 degrees, stick the paperclip into the top about 1/2 inch away from the center. Angle the paperclip so it passes through the hole in the CD and helps hold the two styrofoam halves together.

*When you hang you Saturn up, and it turns in the breeze, you will see the rings" from different angles - just as we see the real Saturn at different angles from the Earth.

Why does Saturn have rings?

Scientists have ideas about why Saturn has rings, but no one knows for sure. One theory or idea is that the rings were formed when a huge asteroid hit and destroyed a moon orbiting around Saturn.

What are Saturn's rings made of? Are they solid like the CD you used to make your model?

Four robotic spacecraft from Earth have already visited Saturn - Pioneer 11, Voyager 1, Voyager 2 and Cassini. They revealed many surprising things about Saturn's rings.

The rings are about 40,000 kilometers (24,000 miles) wide. That's about three Earth's across. But the rings are only 100 meters (330 feet) thick. That's only a little thicker than a football field is long.

They range from particles the size of dust to “particles” the size of a bus. They are made up of silica rock (like sand), iron oxide, and ice particles.

There are actually many rings - maybe 500 to 1000. There are also gaps in the rings. (That’s way we put some black rings on our model Saturn's.) From Earth we can only see a few of the gaps with a telescope. NASA’s Cassini spacecraft discovered that there are thousands of gaps between the rings.

Comet on a Stick - Modeling a Comet in Flight (with a styrofoam ball)

Supplies

1 1/2” styrofoam balls (1 per child)
hairdryer or fan
mylar strips or thin ribbon
scraps of fiber fill (optional)
craft glue (like Tacky Glue)
craft stick or wooden skewer
markers (optional)

A comet is really a big dirty ball of ice. As it passes through the solar system the heat from the sun causes gas, ice particles and rocky debris of various sizes to burst from the comet (called a coma). The solar wind causes these substances for for a “tail” behind the comet.

1. Stick a straw or wooden skewer into the styrofoam ball. Girls can color the styrofoam ball with markers if they want. Glue a bit of fiber fill on the ball to add ice to the surface. Glue strands of mylar onto the styrofoam ball (comet).

2. Turn the hairdryer or fan on (set the fan on low).

The hairdryer is used to simulate the solar winds. Does anyone know what the solar wind is? The solar wind from the Sun, which is made of electrically-charged particles, uses electrostatic attraction and electrical transfer to form the comet's gas and debris into a tail.

Notice that the hairdryer only blows wind in one direction. The sun sends out solar winds straight out from its surface in all directions. (Imagine a ball with spines sticking up all over it.) Hold your comet in front of the hairdryer. What does the tail of the comet do?

3. Have someone be the “Sun” and stand in place with the hairdryer. The hairdryer simulates the solar wind causing the comet tail (mylar) to form and trail behind the comet.

We need a volunteer to be the sun and a second person for the comet in our demonstration. The comet will be traveling around the sun in an elliptical orbit. Can anyone tell me what an elliptical orbit. Our sun will need to keep the hair dryer pointed towards the comet. Everyone else form a circle around our sun and comet.

Now if the comet would move in her elliptical orbit. Watch the tail of the comet. What observations can you make about the tail? It always points away from the sun. Depending on where you are standing the tail may appear to be ahead of the comet. When we view a comet from the earth the direction of the tail changes depending on where comet the is in relation to the sun. Sometimes it even looks like the comet tail is ahead of the comet!

As the comet gets closer to the Sun, the solar heating and solar wind affects the comet so that the tail forms and so that it stays in opposition to (or away from) the Sun. As it travels away, the lost solar heating of the Sun causes the tail to diminish.

Comet on a Stick - Modeling a Comet in Flight (with aluminum foil)

Supplies

2-3 squares of aluminum foil per child
hairdryer or fan
thin ribbon
craft glue (like Tacky Glue)
craft stick or wooden skewer
scraps of fiber fill or cotton balls (optional)

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1. Cut 3-4 pieces of ribbon 2-4 feet long. Tie the ribbon to the end of the craft stick. The knot should be roughly in the middle/ Put a dot of glue on the ribbons and stick to keep the ribbon in place. Hold the ribbon pieces off to one side and gather the aluminum foil around the end of the stick. Form the foil into a ball while keeping the ribbon tail off to one side. Crumple the foil into a lumpy ball. Add a second or third sheet if desired. Scraps of fiber fill may be glued to the comet to add "ice" to the surface.

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Pastel Aurora

Supplies

black or blue construction paper	oil pastels
card stock	scissors
paper towels	

The colors of auroras are the result of atoms in the atmosphere interacting with energy from the sun. The atoms get excited and release bursts of light energy.

Auroras are usually red, green, and blue. The red color is from oxygen atoms in the atmosphere. The greens and blues are the result of nitrogen. Sometimes these colors mix and yellow and pink colors will be seen in the sky.

1. Cut a wavy shape template the long way on a piece of card stock. (These shapes may be precut.)

2. Lay the template on the construction paper. Trace along the edge of the template with a pastel. Go back and forth a few times so lots of color gets on the guideline. It's ok to get a little on the construction paper too.

3. Hold the wavy shape down with one hand and with the other use a paper towel to push the pastel upward so it smudges onto the construction paper. You can go over the area again with more pastels and smudge again with paper towel until you have as much color as you want.

4. Place the template in a different spot and repeat steps 2 and 3 as many times as you like. Try flipping the template, placing the template at different angles, use a different color pastel or a different wavy shape template.

Oreo Moon Phases

Supplies

Oreo cookies (2 per child)	paper plates or paper towels
plastic knives or craft sticks	Oreo Moon Phases print outs

The moon has “phases.” That means it looks a little different to us each night during its 28 day orbit of our planet. We describe how the moon looks with terms such as “full moon.” “first quarter,” and “new moon” (which we can’t really see, because the side that is lit faces away from us).

The moon has no light of its own. Moonlight is sunlight bouncing off the moon’s surface. As the moon orbits Earth, the Sun lights up whatever side of the moon is facing it. To the Sun, it’s always a full moon!

1. Cut a wavy shape template the long way on a piece of card stock. (These shapes may be precut.)

https://spaceplace.nasa.gov/oreo-moon/en/

Worlds in Comparison (Scale model of the solar system using play dough)

Supplies

3 pounds of play dough
table knife
old cookie sheet or other surface for cutting the play dough
instruction sheet
planet name worksheets

http://astronomy.sdsu.edu/projectastro/resources/WorldsInComparison.pdf

Put the instruction sheet and planet name worksheets in plastic sheet protectors or a large plastic bag to keep the play dough from sticking to it. This activity is best for grades 4 and up. Children can work in groups of 3-4 to do this activity.

You will be using play dough to model the different sizes of the planets. Pluto is included in the activity so you can see just how tiny it is compared to the other planets. Take time to be a accurate as possible when dividing up the play dough according to the directions.

Play dough recipe - make two batches for this activity.

2 cups flour
1 cup salt
2 cups water
4 teaspoons cream of tarter
food coloring (add drops till desired color is reached)

Stir the ingredients together in a large pan. Cook over medium heat till mixture comes away from the pan. Cool till you can knead out the lumps.