Educator's Resource Guide

Welcome to Janet's Planet where we are traveling at the speed of thought! This study guide is intended to assist educators as a supplement to our live show, "Janet's Planet, Tour of the Solar System." The resources on the following pages are designed to help your students fully grasp the scientific and theatrical concepts they have experienced, and to nourish the seeds of discovery and adventure that we hope to have planted.

VIEW Janet's TEDx Talk: AWE Inspired Science here:
https://www.youtube.com/watch?v=PP6lEgNbhXk

View Janet's TEDx Talk: How to Inhabit Your Very Own Planet #PlanetYou
https://www.ted.com/talks/janet_ivey_how_to_inhabit_your_very_own_planet_planet_you

Janet Ivey, creator of Janet's Planet, would like to thank you, the educator, for attending the show and want you to know that we are here to serve and are more than willing to do follow up in your classroom via SKYPE. To request a 30–45-minute follow-up SKYPE session, just email us at janet@janetsplanet.com.

We are now using NGSS for all Content Standards and Objectives.
Next Generation Science Standards APP can be found here:
https://ngss.nsta.org/ngss-app.aspx

For I-Phone and Apple Users:
https://itunes.apple.com/us/app/next-generation-science-standards/id683491579?mt=8

For Android Users:
https://play.google.com/store/apps/details?id=com.masteryconnect.NGSS&hl=en

Janet's Planet Tour of the Solar System **"Meets these NGSS AND CC Standards:** NGSS (Next Genera on Science Standards) ESS1-1, ESS1-2, ESS1-3, ESS1-4 CCSS (Common Core State Standards) SL.1.2, SL.2.2, SL.3.2, SL.4.2, SL.5.2

Janet Ivey BULLET BIO

- Creator and CEO of Janet's Planet, Inc.
- President of Explore Mars
- 2nd Round Citizen Astronaut Candidate for Space for Humanity
- NASA JPL Solar System Ambassador
- Award-winning Science Educator
- Author of Unsung Genius Book Series, Celebrating Unsung Women in Science
- 12 Regional Emmy Awards
- 5 Gracie Awards
- STEM-FLORIDA Award for Exploring Microgravity 35-minute documentary for students 3-8
- Board of Governors for the National Space Society
- 2 TEDx Talks, AWE Inspired Science & How to Inhabit Your Very Own Planet #PlanetYou
- Self-Appointed Guardian & Shepherdess of the Next Generation of Space Explorers

Janet's Planet Show Description

Janet's Planet: "Tour Through the Solar System" is a highly interactive stage show where Captain Janet prepares the students to blast off and learn about the STAR at the center of our solar system, the SUN, and every planet (and dwarf planet) that abide on the out er spiral arm of the Milky Way Galaxy! The Tour of the Solar System introduces audiences to the planets, asteroids and dwarf planets in our solar system. Sitting in the auditorium, students are whisked to the surfaces of each planet and can view what we know or imagine each to look like. As students enjoy the view, Captain Janet informs them of the planet's features and interesting characteristics. Janet gets students to act out planet behavior on stage and take quizzes after each planet and win prizes! It's a fun filled ad venture, filled with facts and figures and students will leave with their brains full of knowledge about the solar system and dreaming of stars and space.

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune LESSON/ACTIVITY:

Read through the description of the show and the list of planets in the solar system. Talk to students about a mnemonic and how you can use them to help remember lists of things. Teach them the "My Very Excellent Mother Just Served Us Noodles" for the order of planets.

Encourage students (individually or in groups) to come up with their own mnemonic.

Ex. Mad Veronica Eats Meatballs Joyously Sitting Upon Noodles (anything goes, and whatever helps them remember the order of the planets best)

http://planetfacts.org/planet-mnemonics/ this is a listing of Mnemonics and gives several examples.

Background

A solar system is made up of a star and all the objects that orbit it: planets, moons, asteroids, comets and meteoroids. Most stars host their own planets, so there are likely tens of billions of other solar systems in the Milky Way galaxy alone. Solar systems can also have more than one star. These are called binary-star systems, if there are two stars, or multi-star systems, if there are three or more stars. The solar system we call home is in an outer spiral arm of the vast Milky Way galaxy. It consists of the Sun (our star) and everything that orbits around it. This includes the eight planets and their natural satellites (such as our moon), dwarf planets and their satellites, as well as asteroids, comets and countless particles of smaller debris.

Watch on YouTube

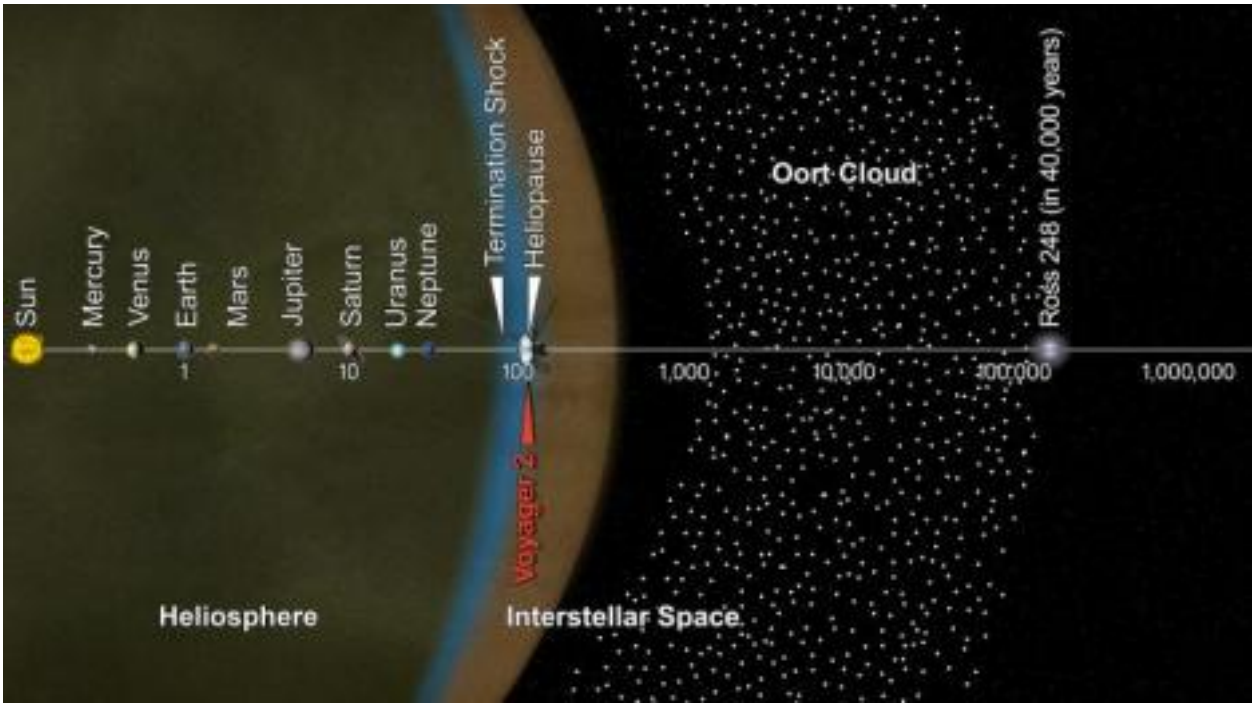
Our solar system formed about 4.5 billion years ago from a dense cloud of interstellar gas and dust. The cloud collapsed, possibly due to the shockwave of a nearby exploding star, called a supernova. When this dust cloud collapsed, it formed a solar nebula – a spinning, swirling disk of material. At the center, gravity pulled more and more material in. Eventually the pressure in the core was so great that hydrogen atoms began to combine and form helium, releasing a tremendous amount of energy. With that, our Sun was born, and it eventually amassed more than 99 percent of the available matter.

Matter farther out in the disk was also clumping together. These clumps smashed into one another, forming larger and larger objects. Some of them grew big enough for their gravity to shape them into spheres, becoming planets, dwarf planets and large moons. In other cases, planets did not form: the asteroid belt is made of bits and pieces of the early solar system that could never quite come together into a planet. Other smaller leftover pieces became asteroids, comets, meteoroids and small, irregular moons.

The order and arrangement of the planets and other bodies in our solar system is a result of the way the solar system formed. Nearest the Sun, only rocky material could withstand the heat when the solar system was young. For this reason, the first four planets – Mercury, Venus, Earth and Mars – are terrestrial planets. They're small with solid, rocky surfaces. Meanwhile, materials we are used to seeing as ice, liquid or gas settled in the outer regions of the young solar system. Gravity pulled these materials together, and that is where we find the gas giants, Jupiter and Saturn, and ice giants, Uranus and Neptune.

Our solar system extends much farther than the eight planets that orbit the Sun. The solar system also includes the Kuiper Belt that lies past Neptune's orbit. This is a sparsely occupied ring of icy bodies, almost all smaller than the most well-known Kuiper Belt object, dwarf planet Pluto. Far beyond the fringes of the Kuiper belt is the Oort Cloud. This giant spherical shell surrounds our solar system. It has never been directly observed, but its existence is predicted based on mathematical models and observations of comets that are likely to originate there. The Oort Cloud is made of icy pieces of space debris the size of mountains and sometimes larger, orbiting our Sun as far as 1.6 light years away. This shell of material is thick, extending from 5,000 astronomical units to 100,000 astronomical units. One astronomical unit (or AU) is the distance from the Sun to Earth, or about 93 million miles (150 million kilometers). The Oort Cloud is the boundary of the Sun's gravitational influence, where orbiting objects can turn around and return closer to our Sun.

The solar wind – a stream of electrically charged gas blowing outward from the Sun in all directions – creates a bubble around the Sun called the heliosphere. The Sun's heliosphere doesn't extend as far as the Oort Cloud. The boundary where the solar wind is abruptly slowed by pressure from interstellar gases is called the termination shock. This edge occurs between 80 and 100 astronomical units. The region beyond the termination shock but before interstellar space is called the heliosheath, and the outer boundary of the heliosphere is called the heliopause. Beyond the heliopause lies interstellar space, the place where the Sun's constant flow of material and magnetic field stops affecting its surroundings.



This artist's concept puts solar system distances - and the travels of NASA's Voy ager 2 spacecraft - in perspective. The scale bar is in astronomical units, with each set distance beyond 1 AU representing 10 times the previous distance. | › Full im age and caption

Two NASA spacecraft, launched in 1977, have crossed into interstellar space: Voy ager 1 in 2012 and Voyager 2 in 2018. Both are still returning data about this mys terious region. But it will be many thousands of years before the two Voyagers exit the Oort Cloud and move out of our solar system, at which time the probes will have long fallen silent, their waning power source having decayed beyond use.

Extensions

- Have students predict solar system scale using this activity. • Have students make a scale model of the solar system using string and beads.
- Have students investigate planetary features using art.
- Engage students in writing poetry about the solar system.
- Engage students in learning how we communicate with spacecraft like Voy ager at such far distances.
- Have students learn more about dwarf planets.

Creating a Clay Model of the Solar System

MATERIALS: 9 index cards, marker, 3 pounds of clay (or dough)

DIRECTIONS: Using a marker, label the 9 index cards with the names of the 9 planets. Then using 3 pounds of modeling clay, follow the 7 steps listed below.

Step 1. **Divide the clay into 10 equal parts (tenths).**

- Use 6 tenths to make Jupiter.
- Use 3 tenths to make Saturn.
- Use the remaining clay (1 tenth) in step 2.

Step 2. **Divide the remaining clay into tenths.**

- Add 5 tenths to Saturn.
- Use 2 tenths to make Neptune.
- Use 2 tenths to make Uranus.
- Use the remaining clay (1 tenth) in step 3.

Step 3. **Divide the remaining clay into fourths.**

- Add 3 fourths to Saturn.
- Use the remaining clay (1 fourth) in step 4.

Step 4. **Divide the remaining clay into tenths.**

- Use 2 tenths to make Earth.
- Use 2 tenths to make Venus.
- Add 4 tenths to Uranus.
- Combine the remaining clay (2 tenths) and use in step 5.

Step 5. **Divide the remaining clay into tenths.**

- Use 1 tenth to make Mars.
- Add 4 tenths to Neptune.
- Add 4 tenths to Uranus.
- Use the remaining clay (1 tenth) in step 6.

Step 6. **Divide the remaining clay into tenths.**

- Use 7 tenths to make Mercury.
- Add 2 tenths to Uranus.
- Use the remaining clay (1 tenth) in step 7.

Step 7. **Divide the remaining clay into tenths.**

- Add 9 tenths to Uranus.
- Use 1 tenth to make Pluto.

LESSONS LEARNED

I personally like to use anywhere from a 5 lb. to 10 lb. ball of Play-Doh so that the students have enough dough to create the scale of the solar system. Clay is very hard to work with, and Play-Doh is much easier to divide with hands and plastic knives. (I just weigh it on my home bathroom scales to make sure I have the amount I want.) (Dollar Store cheapest Variety is fine) or **make your own!**

Also, you can use scales in the classroom to get the students to really get a sense of what 10 EQUAL parts looks like, and to be exacting like a scientist! You CHOOSE!

The original NASA lesson plan calls for a 3 lb ball of clay, I greatly encourage you to do at least 5 - 10 lbs. of dough. It creates a much better scale model and illustration of the difference in the sizes of the planets. FULL NASA SOLAR SYSTEM MATH PDF found here: https://www.nasa.gov/pdf/622144main_SSML1Stdnt.pdf

(Dollar Store cheapest Variety is fine) or **make your own!**

Here is my recipe for home-made Play-Doh:

Ingredients: (I usually triple the ingredients below; it just depends on the amount you want to make. I also think you can use essential oils to make it smell great, lavender, pepper mint or lemon, and you can even use DRY Kool Aid to color the Play-Doh if you are worried about someone being allergic to food coloring.

If you only start with these ingredients, this recipe below will make you a large ball of Play-Doh. I usually make it repeatedly for however many colors I want (so if you want 6 big balls, know that you will need 6 times the ingredients listed above, but you will need to make them separately). I usually triple the recipe from the start and that will yield about 2-3 lbs. of dough.

1 cup flour
1 cup water
2 tsp. cream of tarter
1/3 cup salt
1 TBS vegetable oil
Food coloring or you can use Dry Kool-Aid and knead in the color

Instructions:

1. Mix together all the ingredients, except the food coloring, in a medium saucepan. 2. Cook over low/medium heat, stirring. Once it begins to thicken, add the food coloring. 3. Continue stirring until the mixture is much thicker and begins to gather around the spoon
4. Once the dough is not wet, remove and put onto wax paper or a plate to cool. 5. After cooling (30 minutes) knead Play-Doh for a few seconds.

REFLECTIONS

Watch To Scale: The Solar System
Watch a team of friends create a scale of the distances between the planets using 7 miles of desert. https://www.youtube.com/watch?v=zR3Igc3Rhfg

Follow up questions:

After making a scale model of the Solar System with Play-Doh…

- Who thought that EARTH was a lot bigger than it is?
- Who thought that Mars was smaller than Earth?
- After seeing how tiny Pluto is to scale, what do you think? Is it a planet? Is it just a dwarf planet?

SOLAR SYSTEM: Model of the planets' relative sizes

This activity gives students an idea of the relative sizes of the planets. They will see how much larger the gas giants are to the terrestrial planets and will be able to compare all the planets to the Sun.

Familiarize students with the solar system. If they don't know it already, teach them to order of the planets. The saying "My Very Educated Mother Just Served Us Nachos is useful in remembering the order (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.) Help the students build the following model of the planets.

Supplies needed:

Construction paper
Rulers
Compasses to draw circles (one for each student or group if possible)
Scissors
Tape,
And possibly string

Directions:

Students should work in groups. Measure, draw, and cut construction paper circles of appropriate diameters to demonstrate the general appearances and relative sizes of each planet. Display the model planets in the classroom. They may be able to be hung from the ceiling or taped to the walls. Be sure students understand that, while the relative sizes of the planets are to scale, the distances between the planets will not be. To demonstrate the relative distances between the planets, see the next two activities.

Below are color suggestions and the appropriate sizes for each planet:

Sun: yellow – 109 1/8"
Mercury: gray – 3/8"
Venus: yellow –15/16"
Earth: blue – 1" Moon: white – 1⁄4"
Mars: red – 17/32"
Jupiter: tan – 11 3/16"
Saturn & Rings: tan – 21 5/8", Saturn only: 9 13/32"
Uranus: green –4"
Neptune: blue – 3 13/16" Pluto: gray – 15/64"

This activity can be expanded for older students to include the moons of the planets. Have the students determine the scaling factor for the model by finding the actual diameters of the planets and comparing that with the diameters in the model. After looking up the actual diameters for the moons of the other planets, they can calculate the model size for each moon using the equation below and add the moons to the model.

$$\frac{\text{(planet's model size)}}{\text{(planet's actual size)}} = \frac{\text{(moon's model size)}}{\text{(moon's actual size)}}$$

MODELING DISTANCE IN THE SOLAR SYSTEM

Students often think of the solar system as being composed of huge bodies without much space between them. The following two activities are designed to correct this view and to demonstrate the enormous size of our solar system, in which empty space, not planets, dominates.

The first activity, "The Thousand and Thirty-Yard Solar System," requires a large area (1030 yards) and it allows students to compare the sizes of the planets to the space between them and better demonstrates the hugeness of space.

SOLAR SYSTEM Model: The Thousand and Thirty-Yard Solar System (Model of the plan ets' relative sizes and distances)

To complete this activity, you will need to be able to go outside and walk 1,030 yards in somewhat of a straight line. Going perfectly straight isn't absolutely necessary; you can double back on yourself or go in a circle if needed. While walking this far may seem like a time-consuming activity, the comprehension that students (and possibly you, yourself) will gain about the size of our solar system is well worth it.

Janet's Planet "Tour of the Solar System" supports all the info and to come back and walk the distance of the planets would really make an impact in how big the solar system is and how small Earth is in the scheme of things.

Supplies:
9 index cards
Tape
Objects to represent the Sun and planets:

Sun – any ball, diameter 8 inches
A standard bowling ball is about 8 in. across.
Inflatable balls of about the right size are also fairly easy to find.
Mercury – a pinhead, diameter 0.03 inch Venus – a peppercorn, diameter 0.08 inch **Earth** – a second peppercorn
Mars – a second pinhead
Jupiter – a chestnut or a pecan, diameter 0.90 inch
Saturn – a hazelnut or an acorn, diameter 0.70 inch
Uranus – a peanut or coffee bean, diameter 0.30 inch
Neptune – a second peanut or coffee bean
Pluto – a third pinhead (or smaller item, since Pluto is the smallest planet)

Note:
Using distinct objects, such as peanuts and pins, is helpful because students associate sizes with the objects. This helps them remember the relative sizes of the planets and their tiny size relative to the space around them.

Stick each pin through an index card; this makes them easier to see. Tape the other planet-objects to index cards. Label each card appropriately. This helps keep the planets straight and makes the items harder to lose.

Begin by placing all the objects on a table. Have the students examine them and place the planets in order. If they have trouble, the saying, “My Very Educated Mother Just Served Us Nachos” can help them remember the order. (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.) Once the objects are in the correct order, ask the students how much space they think you will need to make a model of the solar system using these objects. Young students may guess that the tabletop will be enough. Older students may guess the length of the room or the hallway will suffice.

To answer this question, you need to introduce the idea of scale. You can take this discussion to various levels depending on the age of your students. For young students, a common example of scaling is probably sufficient. Here is one you can use: If an auto mobile is 5 meters (500 cm) long and your model car is 10 cm long, then the scaling fac tor is 500 cm ÷ 10 cm or 50.

Point out that in our model the tiny peppercorn represents the entire Earth that we live on! In the real solar system, the Earth is 8,000 miles in diameter. In our model, the peppercorn is about 8/100 of an inch in diameter. The Sun is 8 hundred thousand miles wide and our ball in the model is about 8 inches wide. This means that in our model 1 inch represents 100,000 miles.

This means that 1 yard (36 inches) represents 3,600,000 miles. Take a pace. You have just crossed approximately three million six hundred thousand miles in our model. The distance between the Earth and the Sun is 93,000,000 miles. This is 26 yards in our model. To emphasize how far this is, try to take 26 paces across the room. You will probably hit the opposite wall after about 15. To complete your model, it will be necessary to go outside.

If there’s time before you go outside, have older students calculate the scaled distances between the planets. Below is the scale used for this model:

REAL MODEL

Earth’s diameter 8,000 miles 8/100th of an inch Sun’s diameter 800,000 miles 8 inches Therefore 100,000 miles 1 inch And 3,600,000 miles 36 inches or 1 yard

Entrust each planet to a student and go outside to the beginning of the 1,030- yard route you have chosen.

Start by placing the Sun ball on the ground. Walk 10 paces (about 10 yards) and have the student holding the pinpoint labeled Mercury set the planet down. It’s another 9 paces to Venus and another 7 to Earth. When you get to Earth, turn around and look back at the Sun and the other planets. The distance and tiny size of the planets might seem astonishing! The Sun warms the tiny peppercorn Earth from this far away. We can see Venus when it is “near” the setting Sun on our horizon. And yet there is so much space between the Sun and these inner planets.

Continue on your journey, placing each planet on the ground when you come to the appropriate distance. You may need to place rocks on the cards to keep them from blowing away.

If the distances between the Sun and the terrestrial planets don’t surprise students, the distance to the gas giants should. From Mars to Jupiter, you must walk 95 yards; that’s more than two times further than you’ve walked so far!

The average distances from the Sun to each planet and between the planets, both real and scaled (rounded to nearest yard), are in the table below:

Distance to:	From Sun		From previous planet	
	Real (miles)	Model (yards)	Real (miles)	Model (yards)
Mercury	36,000,000	10		
Venus	67,000,000	19	31,000,000	9
Earth	93,000,000	26	26,000,000	7
Mars	142,000,000	39	49,000,000	13
Jupiter	483,000,000	134	341,000,000	95
Saturn	885,000,000	246	402,000,000	112
Uranus	1,787,000,000	496	902,000,000	250
Neptune	2,800,000,000	778	1,013,000,000	282
Pluto	3,699,000,000	1028	899,000,000	250

When you finish the activity, you will have walked over half a mile. (One mile is 1,760 yards.) Now, look back now towards the Sun. You can't see it. You won't even be able to see it with binoculars! Now look down at the pinhead that is Pluto. You may begin to feel the enormous size of our solar system.

Turn your class around and retrace your steps. Re-counting the paces between the plan ets gives them a chance to learn them and looking for the little objects reemphasizes how lost they are in space.

Have the student who retrieves each planet write on the card a brief description of where it was - "At 9th Street," "In front of the public library"... When you get back to the classroom, you can hang the objects on the wall or from the ceiling to remind the students of their journey.

ART + SCIENCE, Creative Writing and A Bit of Theatre

In this activity, assign groups of students to a particular planet or let them choose. Their objective is to create a 1–2-minute travel video about why humans should visit or "flyby" the planet assigned. They can use their chrome books or computers to do research.

To assist you can ply them with the information below:

Mercury is a barren rock. It orbits the Sun in just 88 days. The side facing the Sun can reach temperatures around 700 degrees Fahrenheit, while the side away from the Sun has temperatures of about -330 degrees Fahrenheit.

Venus has thick clouds of sulfur that trap the Sun's heat and make it the hottest planet in the solar system. It also rotates in the opposite direction as most of the other planets. Of all the planets only Mercury and Venus do not have moons.

Earth is our home and is the only planet we know of (so far) in the whole universe that has life. About 70 percent of Earth is covered in oceans.

Mars is a red planet with very little atmosphere. It is a cold desert with a volcano the size of Utah and a canyon that would stretch across the entire United States. It has ice caps at its poles.

Jupiter is the largest planet and the first of the Gas Giants. It is home to the Great Red Spot, a storm that is so large that the four terrestrial planets could fit inside. Jupiter also has the most moons of any planet. (We know of sixty moons that orbit Jupiter.)

Saturn is the second largest planet. It has bright rings of rock and dust around it. These rings can be seen through a telescope from Earth. Saturn is also the least dense of the planets. If you could make a cup of hot chocolate large enough to put Saturn in it, Saturn would float like a marshmallow!

Uranus orbits the Sun tipped over on its side and rotates backwards. Like Saturn, it has rings made of particles ranging from 10 meters in diameter to tiny pieces of dust. However, unlike Saturn, Uranus's rings are dark and very difficult to see.

Neptune has the fastest winds of any planet in the solar system. The winds of this gas giant can reach 1,200 mi/hr.

Pluto is the smallest, coldest planet in the solar system. It is the only one that hasn't yet been visited by a spacecraft. Most of the time Pluto is the ninth planet, however, due to the eccentricity of its orbit it sometimes comes inside the orbit of Neptune. It is closer to

the Sun than Neptune for 20 years out of its 249-year orbit. Like Uranus, Pluto orbits with its poles almost in the orbital plane.

Have a 'mini film festival' once all the videos are recorded. Upload them to their Chrome Books or your school's YouTube Channel.

Their facts must be factual, but the leaps of fancy about how expensive it might be to stay in a

lava tube hotel can be anything they want to make up.

Have fun…they will learn more in their investigation of things to include in their “commercial” and have a lot of fun along the way.

Dance Your Solar System

Invent a “solar system dance.” Study how the planets behave in their orbits. Choose as many celestial bodies as you have students in class. Those bodies can be the planets, dwarf planets, stars, comets, satellites, etc. Have students decide what to hold/make to represent the celestial body [eg., a picture, a tail (for a comet), a hula hoop (for Saturn)]. Have students research where they belong in the Solar System and also how they might move in their revolutions and in their rotations. Have students practice moving with each other and creating a living model of the so lar system.

Choose Music from “The Planets” by Gustav Holst to play during the students dance and inter pretation of rotation, revolution, and planetary orbits.

http://www.windows2universe.org/ Site with interactive identification of celestial bodies.Stu dents will explore the music “The Planets” by Gustav Holst and also the way sound waves work.

http://www.gustavholst.info/ Official site for Gustav Holst

Each movement of music in The Planets.

http://www.youtube.com/watch?v=L0bcRCCg01I Mars

http://www.youtube.com/watch?v=EE6_PacCnRw Venus

http://www.youtube.com/watch?v=RkiiAloL6aE Mercury

http://www.youtube.com/watch?v=Gu77Vtja30c Jupiter

http://www.youtube.com/watch?v=MO5sB56rfzA Saturn

http://www.youtube.com/watch?v=aDFGmiXnLjU Uranus

http://www.youtube.com/watch?v=rErPKeZmn5w Neptune

FACT: Gustav Holst wrote the music about the planets before a picture of Mercury had ever been taken.

EXPLORATION: Could you write a song about a planet? Would it just be music? Or would your song about a planet have lyrics too?

Watch and listen to Janet’s Planet song about the planets here:

http://www.youtube.com/watch?v=6L5bnGvK%sA

Internet Resources

NASA's Next Gen STEM Curriculum

https://www.nasa.gov/stem/nextgenstem/index.html

https://solarsystem.nasa.gov/solar-system/our-solar-system/overview/

http://solarsystem.nasa.gov/kids/ NASA kids site

http://spaceplace.nasa.gov/menu/solar-system/ NASA solar system

http://www.nasa.gov/audience/forkids/kidsclub/flash/ NASA space games

http://mel.ess.ucla.edu/jlm/epo/planet/planet.html What is a planet?

http://www.infoplease.com/spot/pluto-demoted.html Information for pluto.

http://www.iau.org/public/themes/pluto/ Definitions of planets and other celestial bodies

http://spaceplace.nasa.gov/chandra.htm NASA Space Place for kids

Best Books for Kids About Space

Hello World, Solar System by Jill McDonald (ages 2 – 5)
Perfect for toddlers and preschoolers, this nonfiction book about space is very age-ap propriate. It asks questions and shares basic information in an accessible way. "*Mercury is the closest planet to the sun. / Ouch! Asteroids and comets often hit this planet.*" Cheerful paper cut, collaged illustrations make this very visually appealing.

Animals in the Sky by Sara Gillingham (ages 4 – 8)
Riddles help kids learn the constellations by their shapes with lift-the-flap answers and that give the answer and more information. "*I have a big bushy mane, a long tail, and a loud roar. I am the king of the jungle! What animal in the sky am I? I am the Lion. My brightest star is called Regulus, which means "little king."*" The white and gold text and illustrations pop out off the page set onto turquoise and navy blue backgrounds.

XO, Exoplanet by Deborah Underwood, illustrated by Jorge Lacera (ages 4 – 8) **Get ready to laugh at this hysterical story with a poignant message about seeing mul tiple perspectives!** When our solar system's planets write a friendly letter to an exoplan et, their communication turns into a funny argument when the exoplanet tells our plan ets that THEY are actually the exoplanets. A visiting comet helps our planets to see that depending on how you're looking at things, both arguments could be true. Letters, dia logue bubbles, and expressive illustrations capture the planets' strong emotions.

Molly's Moon Mission by Duncan Beedie (ages 4 – 8)
Preschoolers will love this exciting adventure of a moth who wants to fly to the moon. Even when everyone tells her it's impossible, Molly persists. She gets higher and higher and finally achieves her mission. Darling.

My Pop-Up Space Book by DK (ages 4 – 8)
Isn't this book fun!? Kids love pop-up. Add science information about space — the Earth, sun, moon, stars, space travel, and astronauts — and you've got an excellent nonfiction book choice for young learners.

A Place for Pluto by Stef Wade, illustrated by Melanie Demmer (ages 4 – 8) Pluto used to be one of the famous 9 planets until one day he gets the worst news ever… he is too small to be a planet. He's crushed. He searches the galaxy to find a place he fits. But he learns about comets and he's not a comet. He talks to asteroids and meteoroids and he's not one of them either. Finally, he discovers someone who looks just like him — a dwarf planet. The story skillfully entertains while educating readers about Pluto and other solar system elements. Great artwork throughout this fantastic, emotionally resonate story.

Mars: Earthlings Welcome by Stacy McAnulty, illustrated by Stevie Lewis (ages 4 – 8) **Mars is a planet with a big personality. In first-person narration, Mars shares all its many features**

that are much better than Earth's. Like two moons and 37 more minutes in a day! It's funny, entertaining, and very informative. I would love to use this in a writ ing class to teach voice, point of view, and even organization.

Sun and Moon Together by Ethan Long
Long's created a community (Happy County) with silly cartoons and stories that explain factual information while engaging the reader's attention. Learn about the Sun and the Moon, the water cycle, the solar system, and delight in stories about characters like Wilbur and Orzo Bright whose hot air balloon pops and sinks to the bottom of the ocean. There's so much to learn, see, and do in this entertaining book.

Astro Girl by Ken Wilson-Max
Father and daughter talk about the daughter's plan to be an astronaut. Their playful relationship showcases the things that you must do as an astronaut — go around and around, eat food out of tubes, get used to zero gravity, and so forth. And the ending reveals that the girl wants to be just like her astronaut mom who has just returned from space.

Moonwalkers by Mark Greenwood and Terry Denton
Set during the historic moon landing, this story is about three imaginative siblings who pretend to play right along with the astronauts — talking to Mission Control, dressing in spacesuits, exploring the moon. Kids will pour over the fantastic, funny illustrations with many interesting details. The back matter explains the Apollo 11 Mission.

Heart on Pluto by Karl Jones, illustrated by Andrew J. Ross
A satellite named New Horizons narrates his exciting adventure from Earth, passing planets, all the way to Pluto; a trip that takes 9 years. He says he doesn't feel lonely because there's a heart on Pluto and love from the Earth. Back matter with facts helps add depth to this picture book.

Everything Awesome About Space and Other Galactic Facts! by Mike Lowery I love the layout and design of this book, it's a feast for the eyes and makes this informational book fun to read. Plus, readers will learn a lot about space including stars and space exploration.

Space Coloring Book by Blue Wave Press
Full-page drawings of planets, spaceships, rockets, and even aliens.

Peel & Discover: SPACE
Learn space facts about the planets, astronauts, asteroids, and constellations and use your stickers to fill in the illustrations.

The Space Walk by Brian Biggs
Who knew being an astronaut would be so boring or would have so many rules? After Randolph does everything Ground Control wants, he finally gets to go out for a spacewalk where he has a blast and makes a new friend. Vibrant illustrations.

Birthday on Mars! by Sara Schonfeld, illustrated by Andrew J. Ross
Introduce the Mars Rover to young readers with this simple story about **a robot named Curiosity who lives on Mars.** He tells readers how his friends sent him to Mars to explore. He sends pictures home and takes a selfie birthday photo.

Astronaut (Busy People) by Lucy M. George, illustrated by AndoTwin (ages 4 – 8) This is a wonderful, ethnically diverse picture book about Jenny and her work as an as tronaut. Readers will enjoy finding out about Jenny's day on the space station, including the hi-jinxes of her Robot-bot. The book concludes with more information and vocabu lary as well as activities. Well done!

If You Decide to Go to the Moon by Faith McNulty, illustrated by Steven Kellogg (ages 4 – 8) Written directly to the reader (you), this book gives you instructions for what to pack and expect if you travel to the moon. You'll travel to the famous Sea of Tranquility where the first moon expedition landed. I like the facts and how the authors make the idea of moon travel personal as if we were really making this plan.

Mae Among the Stars by Roda Ahmed, illustrated by Stasia Burrington (ages 4 – 8) Beautifully illustrated and inspirationally written! Little Mae dreamed of becoming an astronaut. Her parents told her she could do it if she worked hard, taking Mae to the library to find information and encouraging her astronaut pretend play after dinner. Despite her teacher's discouragement ("Nursing would be a good profession for someone like you"), Mae listened to her mom and stuck to her dream. Mae kept dreaming, believing, and working hard. She (Dr. Mae Jemison) succeeded; she became the first African American female astronaut in space.

Papa Put a Man on the Moon by Kristy Dempsey, illustrated by Sarah Green (ages 4 – 8) I like the simplicity of this story that gives us a snapshot of an important time in history, the moon landing, through the eyes of a little girl whose hard-working blue-collar father worked on the fabric of the astronaut's spacesuits.

The Moon Book by Gail Gibbons (ages 5 – 8)
This book has it all — from the lunar cycles to the moon's effect on the oceans to the moon's importance in various cultures, you'll find everything in this helpful, illustrated nonfiction book.

Little Kids First Big Book of Space by National Geographic Kids (ages 6 – 12) I LOVE this book — it's like yummy mind candy. The vivid photographs and colorful layout catch your attention. The information shared is just the right amount of text and facts per page as to not overwhelm readers.

Pluto's Secret An Icy World's Tale of Discovery by Margaret A. Weitekamp with David DeVorkin, illustrated by Diane Kidd (ages 4 – 8)
This is a fascinating story of Pluto that will engage your kids (and you!) When Clyde Tombaugh discovered Planet X, a little girl who suggests the name Pluto after the Roman god of the dark underworld. She imagines Pluto was so far from the sun that it must also be a cold, dark place. However, Pluto knows he is no planet. So when astronomers de clare him to not be a planet, he is thrilled. "Bingo!"

Astronaut Handbook by Meghan McCarthy
After reading all these books about space, your child might be wondering what it takes to become an astronaut! This picture book talks about the different jobs astronauts have and the hard work that you must put in before achieving this goal.

To Burp or Not to Burp A Guide to Your Body in Space by Dr. Dave Williams and Loredana Cunti, illustrated by Theo Krynauw (ages 6 – 12)
When you gotta go and you're an astronaut, what do you do? Well, this book explains the details of peeing and pooping in space which is quite fascinating actually. But what about hair, brushing your teeth, taking showers, boogers, and burping? Well, you'll find out that burping is high-risk without gravity and plenty more answers to the questions you never knew you had!

The Magic School Bus Lost in the Solar System by Joanna Cole
If you know these stories, you'll expect that Ms. Frizzle takes her kids on a school bus – turned spaceship — through the solar system where they learn about space and experi ence harrowing adventures.

You Are the First Kid on Mars by Patrick O'Brien (ages 5 – 8)
This book imagines a future scenario where people live on Mars, maybe traveling through a space elevator to a space station to a rocket that will take you there. Once you're living there, you can expect to help scientists and engineers with their important work. As you read this imagined future, you'll learn information about the planet Mars.

Bok's Giant Leap by Neil Armstrong, illustrated by Grahame Baker Smith (ages 5 – 8) **Who is Bok the Moon rock?** When a smaller planet crashes into Earth, it makes the Moon. A **small Moon chunk breaks off and is called Bok.** Bok remembers different events (dinosaurs, Ice Age) but misses some of the famous scientists and the launch of a space shuttle on Earth. Then one day, Bok is scooped up by an astronaut named Neil Armstrong and brought to Earth to share. Stunning illustrations.

Space Adventure Activity Book by Jen Alliston (ages 8 – 12)
This space activity book is so eye-catching, I love it! It's filled with stickers, dot-to-dots puzzles, mazes, word searches, coloring, and more. Kids will take a cosmic journey of ad venture throughout every page!

Max Goes to The Moon by Jeffrey Bennett, illustrated by Alan Okamoto (ages 6 – 10) Tori and her dog Max quest to the Moon, the first trip there since Apollo. Their trip in spires people back on Earth. The world joins together in building a great Moon colony, complete with a university and an astronomical observatory. 19 insets of information on each page give readers pertinent factual information about the phases of the moon, travel to the moon, and more. You might also like: *Max Goes to Mars* and *Max Goes to Jupiter*.

Finding the Speed of Light: The 1676 Discovery that Dazzled the World by Mark West on, illustrated by Rebecca Evans. Story boxes and cartoon panels with often funny dia logue sit on deep purple background illustrations of starry skies. These combine to tell the history of Ole Romer, a Danish astronomer who discovered Jupiter's four moons as well as his biggest discovery of all– the speed of light. There's a lot of text but the car toon panels break it up a little. Add this to your science classrooms and units on space.

Planets by National Geographic Kids / Elizabeth Carney (level 2 reader) (ages 6 – 9) National Geographic Kids provides another fantastic nonfiction book with readable text for beginning readers without sacrificing content. Your kids will learn so much about the different planets in this little book. Can also be read aloud to younger children.

Mars Is…Stark Slopes, Slivery Snow, and Startling Surprise by Suzanne Slade Use this unique book as a mentor text for nonfiction text structure as well as writing ex pository nonfiction with sensory images. Not only is the text beautiful but the EPIC close-up photos will immediately draw your attention.

Rocket to the Moon: Big Ideas That Changed the World by Don Brown Instead of reading a narrative nonfiction book, this fact-filled history about the first moon landing is an exciting, well-written, black-and-white **graphic novel.** Reading this book will help your kids understand our country's competitiveness with Russia, the many attempts to launch rockets, and the eventual success of sending astronauts into space.

Astronauts: Women on the Final Frontier by Jim Ottaviani and Maris Wicks What a fascinating, informative look at the difficult road that women faced in their jour ney to become astronauts! Despite facing misogynistic attitudes, American women per sisted in their quest to become astronauts. Meanwhile, the Russians started a female space program and launched a woman astronaut long before the U.S. did. Eventually, the U.S. caught up and you'll be inspired by reading the stories of these fascinating trail blazers, American and Russian.

Additional Reading:

Planet Name Game (Dr. Seuss/Cat in the Hat -- Step into Reading) by Tish Rabe, Random House Books for Young Readers (January 6, 2015), Grades K-1

You Are the First Kids on Mars by Patrick O'Brien, G.P. Putnam's Sons Books for Young Readers (May 12, 2009), Grades K-3
The Planets in Our Solar System (Let's-Read-and-Find-Out Science, by Franklyn M. Bran ley (Author), Kevin O'Malley (Illustrator), HarperCollins; Reissue edition (August 4, 2015), Grades K-2

Zoo in the Sky: A Book of Animal Constellations, by Jacqueline Mitton & Christina Balit, National Geographic Children's Books; Reprint edition (October 24, 2006), Grades K-3

I Want to Be an Astronaut by Byron Barton, HarperCollins; Reprint edition (February 28, 1992), Grades K-3

Postcards from Pluto: A Tour of the Solar System by Loreen Leedy, Publisher: Holiday House; Revised edition (July 15, 2006), Grades 1-3

National Geographic Reader: Planets by Elizabeth Carney, National Geographic Chil dren's Books (July 10, 2012), Grades 2-4

Our Solar System by Seymour Simon (Smithsonian), Grades 3-6
The Latest View of the Solar System, (National Geographic Kids), by David Aguilar, Grades 4-6

Child's Introduction to the Night Sky: The Story of the Stars, Planets, and Constellations-- and How You Can Find Them in the Sky, by Michael Driscoll (Author), Meredith Hamilton (Author), Black Dog & Leventhal; Stk edition (May 1, 2004), Grades 4-6

Destination: Space by Seymour Simon, HarperCollins; Revised ed. edition (May 23, 2006), Grades 4-7

Exploring the Solar System: A History with 22 Activities by Mary Kay Carson, Chicago Re view Press; Revised edition edition (February 1, 2008), Grades 5-8

Almost Astronauts: 13 Women Who Dared to Dream, by Tanya Lee Stone, Candlewick Press,

2009, Grade 5-8

Astrophysics is Easy!: An Introduction for the Amateur Astronomer by Michael D. Inglis, Springer; 2 edition (December 4, 2014)

The Backyard Astronomer's Guide by Terence Dickinson and Alan Dyer, Firefly Books; En larged 3rd edition (September 12, 2008)

Space: From Earth to the Edge of the Universe by Carole Stott, Robert Dinwiddie, David Hughes and Giles Sparrow, DK Publishing (October 4, 2010)

Wonders of the Universe by Brian Cox and Andrew Cohen, Harper Design (October 4, 2011)