Create You Own Exoplanet Project



**Assigned: Monday, May 3, 2021**

**Due: Friday, May 14, 2021**

When you look at the night sky and see far away stars, do you ever wonder if there are planets around those stars too? Planets around other stars are called, **exoplanets**, and so far over four thousand have been discovered! Our best guess is that are likely hundreds of billions in the Milky Way alone. You are probably familiar with the planets in the Solar System, but exoplanet systems are very diverse and don’t always look like the planets we know and love. In this activity you’ll learn more about exoplanets and you’ll get creative in imagining what these other worlds may be like!

Before you get started imagining your own exoplanet, let’s learn about what exoplanets are and what we know about them. We will also watch the 2015 movie, the Martian, in order to see what it would take for humans to live on a planet in conditions unlike those on Earth. After watching the movie and discussing it, follow the following steps before creating your exoplanet.

**Steps:**

1. **What is a planet anyway?**

To learn what an exoplanet is, we need to start with what a planet is. There are three requirements for an astronomical object to be a planet:

* **It needs to orbit a star.**
* **It needs to be large enough to be shaped like a ball.**
* **It needs to ‘clear its path’ around the Sun.**

**Why Isn’t Pluto a Planet Anymore?**

<https://www.youtube.com/watch?v=UbXjqdNRaLY>

* In our own solar system, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune all fulfill these requirements. Jupiter’s moon Ganymede and Saturn’s moon Titan are both larger than the planet Mercury, but because they orbit other planets rather than the Sun directly, they are moons. Lots of objects in the asteroid belt do orbit the Sun, but they are not large enough in mass for their self-gravity to make them spherical in shape, and they are not able to clear their path around the sun. Finally, Pluto was excluded as a planet because it is not massive enough to clear its disk-shaped orbit around the Sun of small, icy solids.
* Exoplanets, also known as extrasolar planets, are planets in other solar systems (which means they orbit around other stars).
1. **How to Find an Exoplanet**
* Finding exoplanets is extremely difficult. It’s like trying to detect a penny on the moon! How do we find exoplanets then? The most common methods of detection are direct imaging, radial velocity, and the transit method. Sometimes, if a planet is really big and not too far away, and orbiting far away from its star, we can see it directly using a really sensitive telescope – this is called the **direct imaging method**.
* For other planets though, astronomers have to get clever. One trick they use is to watch the star very closely and see if it “wobbles”. If it wobbles a little bit, it means there must be a planet orbiting around it, and the star and the planet are tugging at each other through gravity. This is the **radial velocity method**.
* Another trick is to watch and see if the star gets less bright sometimes, since this could mean a planet is getting between us and the star and blocking out some of the light. This is called the **transit method**. We can also use these strategies to learn about the exoplanet, like how often it goes around its star and how big and how heavy it is.
1. **Types of Exoplanets**
* **Where would you like to go for your next vacation? If you enjoy a good game of “the floor is lava”, you might want to consider**[***55 Cancrie***](https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/explore-55-cancri-e/?travel_bureau=true)**. Are you a Star Wars fan who always wanted to see that double sunset on Tatooine? Consider taking in the views on**[***Kepler 16b***](https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/explore-kepler-16b/?travel_bureau=true)**.**
* While you might be familiar with the 8 planets in our solar system, planets around other stars come in many more varieties. There are “hot Jupiters” – giant planets made of gas that orbit near their star. Or there are “super-Earths”, which are rocky worlds more massive than the Earth, and many more.
* Check out more exoplanets here: <https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/explore-55-cancri-e/?travel_bureau=true>
1. **Exoplanet Climate and the Goldilocks Zone**
* Not every exoplanet is as lucky as Earth. We have luscious forests, warm tropical beaches, and even humans because of our distance from the Sun. If we were further away from the Sun, all our water would freeze like on some of Jupiter’s moons. If we were closer to the Sun, all of our water would evaporate like on Venus. We are in what is known as the Goldilocks Zone, the perfect distance away from our Sun to have the liquid water that makes life possible. Astronomers have been looking for exoplanets in other stars’ Goldilocks Zone – these planets might be able to support life!
* **Experiment and explore:**[Check out this visualization of all known exoplanets and their host stars, and explore what it means to be in the habitable zone](http://tulpinteractive.com/goldilocks/).
* **Check out these videos:** <https://youtu.be/u2OlT9bECqg> and <https://youtu.be/xaaN7Dffw4w>
1. **Is There Life on Exoplanets?**
* Water isn’t the only thing life needs to survive. When we study an exoplanet’s atmosphere, there are many different elements we look for to try and model the planet’s climate. Exoplanets come in a wide variety (read the Types of Exoplanets section above!) so knowing their distance from the star is only half the story. Knowing what elements are in the atmosphere helps us figure out if these distant worlds have oceans, clouds, glaciers, or even life!
* **Check out these videos:** <https://youtu.be/W1bel0ODIDE> and <https://youtu.be/yBdyFKqwKy0>
1. **Create your exoplanet:**
* For this challenge, we have two choices! You can either create a diorama depicting what it is like to be on your exoplanet, or you can create a poster or prezi depicting what it is like to be on your exoplanet.
* Diorama Choice
	+ A diorama is a way of making a 3D picture of something. It’s built inside of a box, like a shoe box or tissue box, and depicts another place. In this activity you’ll create a diorama of what it’s like on the surface of your own planet!
	+ Here is an example of making an arctic diorama. In our case, we will be making one for your exoplanet. <https://youtu.be/IcaRozlooag>
* Poster/Prezi Choice:
	+ Instead of making a 3-D model of your exoplanet, put all the information on a poster or in a prezi.

**Inspiration**

* If you’d like some inspiration, remember to check out some real exoplanets using this [app from NASA](https://outreach.phas.ubc.ca/phenomenal-physics-astronomy-at-home/challenge-no-4-create-your-own-exoplanet/_wp_link_placeholder), or check out the [exoplanet travel bureau](https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/explore-55-cancri-e/?travel_bureau=true), where you can see some depictions of the surfaces of different exoplanets.

**For either choice, your project must include the following:**

1. Name of your exoplanet
2. Size (in relation to Earth)
3. Type of atmosphere (what elements or molecules make up the atmosphere, does it rain or snow? What color is your sky? Are there clouds? What about wind?)
4. Type of surface (Is it solid? What color is it? Are there rivers, lakes, or seas? Mountains and valleys, hills, completely flat? Is agriculture possible in the soil, if any? Grow plants using hydroponics?)
5. Type of star or stars it orbits (Include color, size of star, it has to be a realistic star, refer back to our unit on stars for ideas)
6. Who would you send to live on your exoplanet and why? (Only scientists? Anyone can go? Only those rich enough to afford it?)