Gravity and Your Weight in the Solar System

We experience gravity every day, but understanding gravity is quite complex. Take a tour of the solar system to understand the relationship between gravity, mass, and wieght.

Grades

- 3-6

Time

- 45-60 minutes

Next Generation Science Standards

- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

Utah Science Standards

- 3.4 Students will understand that objects near Earth are pulled toward Earth by gravity.
- 6.1.2 Develop and use a model to describe the role of gravity and inertia in orbital motions of objects in our solar system.

Materials

- A scale (or just guess your weight)
- A lab sheet

Key words to know

Gravity is a force which tries to pull two objects toward each other. Anything which has mass also has a gravitational pull. The more massive an object is, the stronger its gravitational pull is. Earth's gravity is what keeps you on the ground and what causes objects to fall.

Mass is a measure of the amount of matter (or stuff) in an object. Mass is measured in grams (g) or kilograms (kg). Mass is constant in all circumstances. Objects with more mass exert more gravitational pull.

Weight is the measurement of the pull of gravity on an object. Weight can change. An object weighs the same in China or the US, but take that object to the moon, and it will have a different weight! Why, because the moon places a different force of gravity on that object than the Earth does, this is due to the differences in the moon and the Earth's mass.

Directions

- Start by watching the introductory video to this lesson on the video tab here:

  http://www.greatbasinobservatory.org/lesson-plans/zhomeschool-gravity-and-your-weight-solar-system

- Now weigh yourself on a scale, or just guess your weight. Write your weight in the space below.
- Now start touring several places in the solar system to see how much your weight changes in different locations. Do the math with a calculator or long hand and fill out the table.

Place	Relative force of Gravity	Multiplied by	Your Weight	Equals	Your Weight In this location
Earth	1	x		=	
Outer Space	0	x		=	
Earth's Moon	0.17	x		=	
Mercury (the smallest planet)	0.38	x		=	
Jupiter (the largest planet)	2.36	x		=	

Now complete the sentences using the words below.

Objects, including me, have mass. Mass is the amount of _____ in an object. _____ does not change. It stays constant. No matter where an object is in the universe it has the same mass.

On Earth we rarely measure our mass, we measure our _____. We are so used to experiencing the _____ of Earth that we usually don't think about it pulling us down. But, every time we weigh ourselves or another object on Earth we are actually doing a measurement that involves gravity– because weight is actually the measurement of the pull of gravity on an object.

The crazy thing is that since all objects with mass have gravity, that means that I exert gravity too! But, alas, the _____ is so much more massive than me, that you can't feel my attraction.

Words to use

Earth mass stuff weight gravity

Further challenges

- Explain to a parent or sibling what gravity is and why your weight changes as you travel through the solar system.
- Tell them which place you would like to visit most and which place your would like to visit least. Describe what types of activities would be fun to do on other planets? What would be challenging?
- Fun follow up. Check out the super fun videos of an astronaut doing normal activities like sleeping, brushing his teeth, and washing his hands in the international space station.

http://www.greatbasinobservatory.org/lesson-plans/gravity-and-your-weight-solar-system

- Mind Bender Alert, the following is only for those ready to have an achey brain– Are you interested in knowing your weight on all the planets? Here is a table of calculation for you. Fill it out, but be prepared to notice some weird things!

Location	Your weight on Earth	Relative force of Gravity	Your weight on this planet
Mercury		x 0.38	
Venus		x 0.91	
Earth		x 1.0	
Mars		x 0.38	
Jupiter		x 2.36	
Saturn		x 0.9	
Uranus		x 0.89	
Neptune		x 1.1	

Here is the mind bender, Jupiter, Saturn, Uranus, and Neptune are **much** larger than Earth.

Why don't you weigh more on all the large planets? Why do you only weigh more on Jupiter and Neptune?

Things start getting tricky here. When dealing with gravity, mass is important, but also how much mass is in how large an object. How closely is that mass held together?

The gas giants are huge, but also composed of light substances like ice and gas. Check this out- Uranus is 14 times the mass of Earth, but it is 63 times the size of Earth! That is why relatively speaking you weigh less on this giant planet.