Gravity’s effect on

**Name**:

**Hour**:

**Learning Target**: I can explain how the mass of an object affects the gravitational attraction between objects.

gravitational attraction between objects.

*Definitions*:

**Mass**: the measure of the amount of matter that something is made up of; remains constant regardless of location

**Gravity**: The force that pulls two bodies together; increases as the size of the body increases

**Weight**: Force on the gravity of an object; relative to the mass of an object; changes based on the gravity

*Gravitational Pull*

Weight is the force gravity exerts on an object due to its mass. Mass, roughly, measures an object's inertia, its resistance to being moved or stopped, once it's in motion. Your mass remains constant across the universe, while your weight changes depending on the gravitational forces acting on you, which vary from planet to planet.

Newton's Law of Universal Gravitation says that everything that has mass attracts every other thing that has mass, pulling with a force (a) directly proportional to the product of the two objects. However, gravity decreases exponentially as the distance between them increases. When calculating surface gravity, that distance refers to the space separating you (on the surface) from the planet's center of mass. This means that a planet's size actually has a greater relative impact on its gravity and on your weight on its surface than does its mass.

*Challenge*

You are a space traveler… a super good one. So amazing, that you travel to all of the planets in the solar system. Having a $3 billion dollar space suit, personal rocket-ship, and eternal youth makes this easier for you. There is one catch though, you want to make sure you are wearing the right shoes for each planet; you see, your shoes are sensitive to gravity. You have 3 pair: the Nike’s can only be worn when your weight is less than 30, the Adidas can only be worn when your weight is between 31 and 120, and the Air Jordan’s can only be worn when your weight is bigger than 100. Using the following formulas and data, which shoes should you wear on each planet?

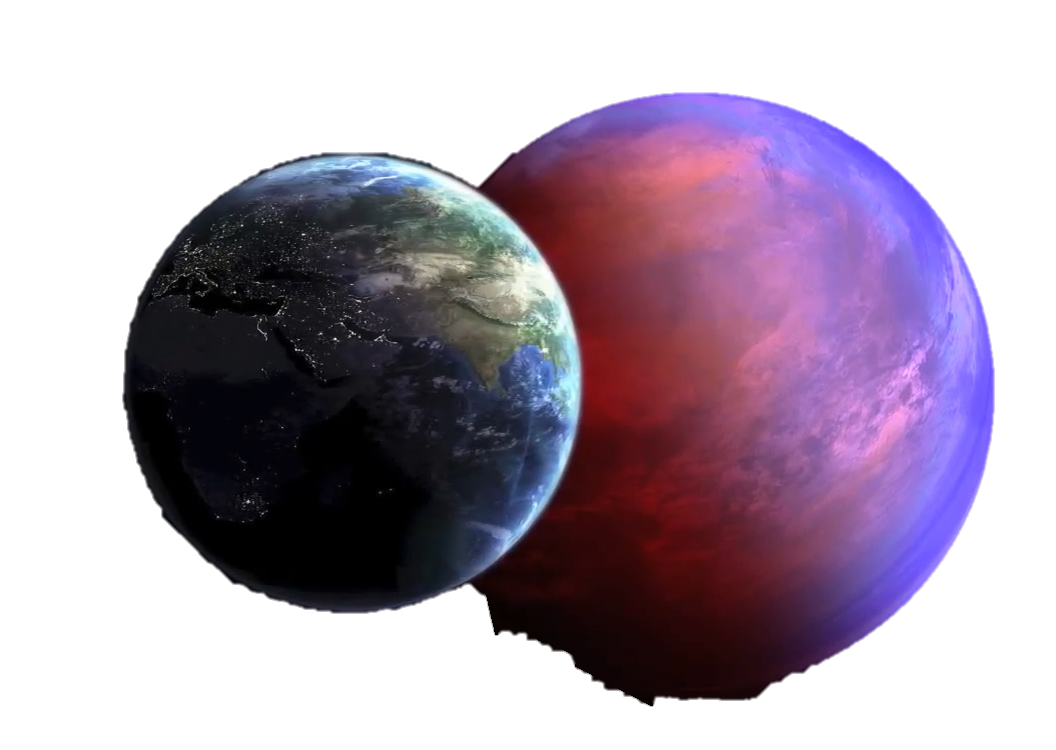
Mass &Weight

*Formula:*

My Weight

X Gravitational Proportion

My Weight on other Planet



|  |  |  |  |
| --- | --- | --- | --- |
| Planet | Gravitational Pull Compared to Earth | My Weight in pounds on Planet | Shoes |
| Mercury | 0.38 |  |  |
| Venus | 0.91 |  |  |
| Moon – not a planet | 0.16 |  |  |
| Mars | 0.38 |  |  |
| Jupiter | 2.36 |  |  |
| Saturn | 0.91 |  |  |
| Neptune | 0.89 |  |  |
| Uranus | 1.12 |  |  |
| Pluto– not a planet | 0.06 |  |  |



**How far could I jump on another planet?**

Determine how far you can jump on the Earth. To do this, place a piece of tape on the floor as a starting line. Jump as far as you can off of both feet. Have your partner mark where you land not where you end up! Measure the distance and record in the table. Do this five times, then find the average.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 | Average |
|  |  |  |  |  |  |

Now it is time to get on your space shoes and see how far you can jump on each planet…

|  |  |  |
| --- | --- | --- |
| Planet | Gravitational Pull Compared to Earth | My Jump distance on other planet |
| Mercury | 0.38 |  |
| Venus | 0.91 |  |
| Moon – not a planet | 0.16 |  |
| Mars | 0.38 |  |
| Jupiter | 2.36 |  |
| Saturn | 0.91 |  |
| Neptune | 0.89 |  |
| Uranus | 1.12 |  |
| Pluto– not a planet | 0.06 |  |

*Formula:*

Average Jump

÷ Gravitational Proportion

My Jump on other planet

*Complete each statement:*

A person would weigh more on \_\_\_\_\_\_\_\_\_\_\_\_ than on \_\_\_\_\_\_\_\_\_\_\_\_\_, because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A person could jump further on \_\_\_\_\_\_\_\_\_\_\_\_\_ than on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The force of gravity between two objects depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_