Weight Online Reading & Notes

Part 1:

Directions:

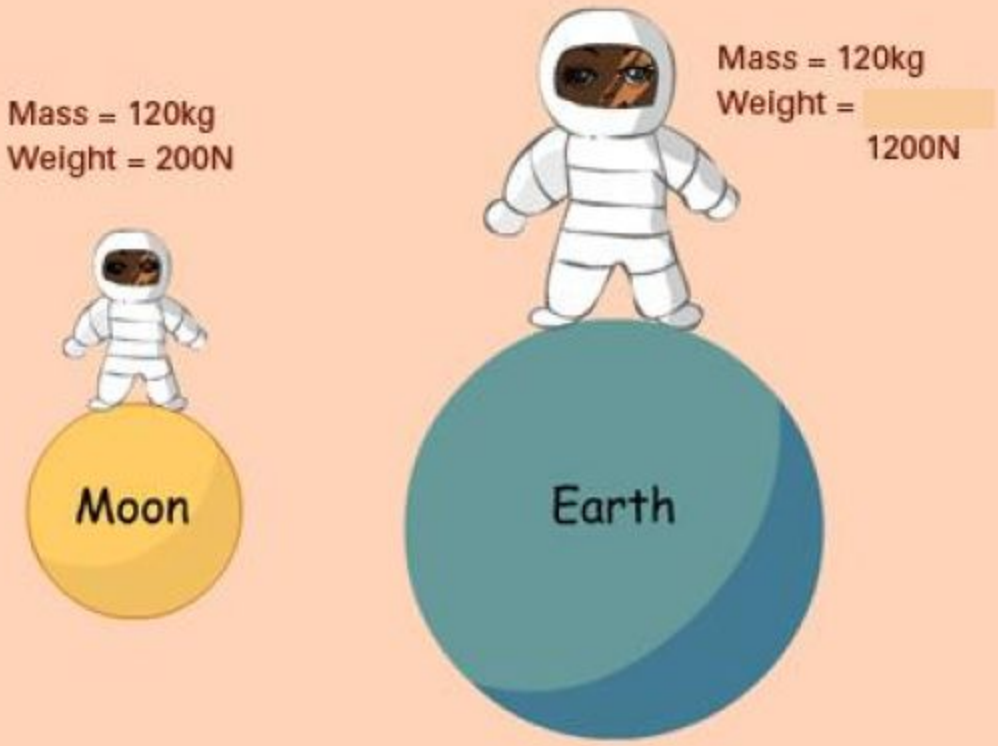
a. ***Read** the second article from "eSchool Today - All About Forces"*
b. *Once you are finished reading complete the **questions** below.*

What is Mass

Every object is made up of matter (Matter is everything except energy). The more matter an object has, the bigger it is (usually), and the more mass it has. Mass is measured in kilograms, kg, or grams, g. Objects that have a big mass are harder to move, or harder to stop than objects with little mass.

Mass is how heavy something is without gravity.
This means the mass of an object is the same on earth and in space (or other planets)

A 100g ball will be 100g everywhere, even on the moon. This fact is not the same for weight. The weight of an object can change in a different place, such as on the moon.



In the illustration above, notice how the mass of an astronaut remains the same, while her weight is smaller on the moon, as a result of less gravity.

Mass in NOT the same as weight. The difference is that weight is determined by how much something is pulled by gravity. If we compare two different objects to each other on Earth, they will both be pulled by the same gravitational force, so the one with more matter will weigh more.

What is Weight?

Weight is a force caused by gravity; because it is a force, it is measured in **Newtons (N)**. It is the gravitational force between the object and the Earth. An object will have greater weight if it has more mass.

All over the world, people read the weight of objects with kilograms. That is not correct. It is done only because it is easy for people to grasp. The proper scientific unit of measurement for weight is Newtons, and it is written as N.

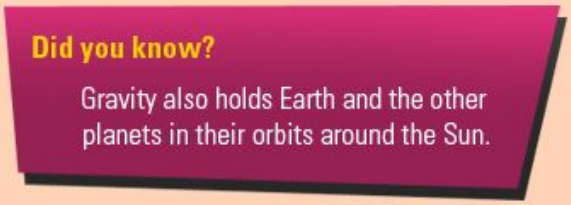
As mentioned in the previous page, the weight of an object will remain the same ONLY when the object is under the same pull of gravity. In Space, there is no gravity so the object will not even sit on the scale at all! It will just stay suspended! Technically speaking, there is no weight in the middle of space where there is no gravity.

Gravity on the Moon is less than on Earth. That means an object will weigh less on Moon than on Earth.

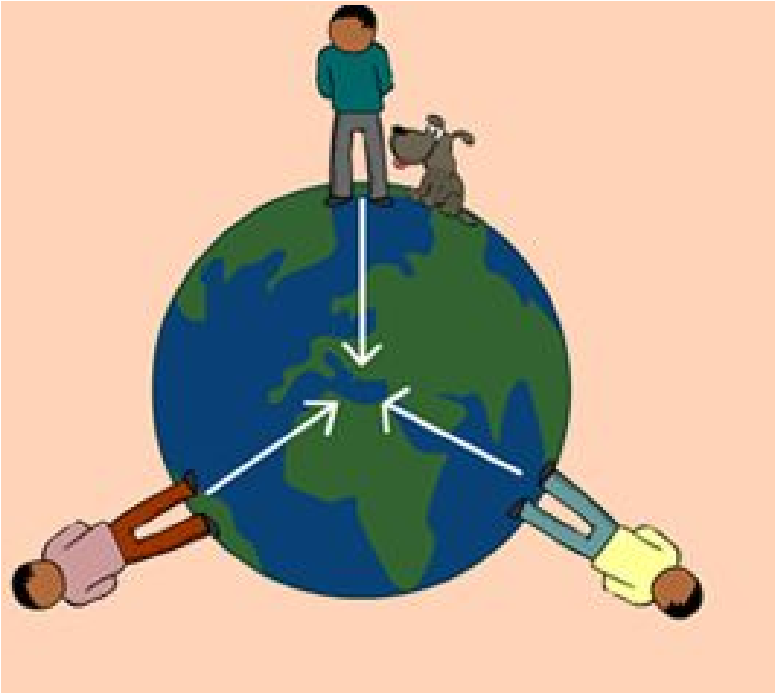
What is Gravity

All objects with mass have a force that attracts them towards each other. This force is called *gravity*. Even you attract other objects towards you because of gravity, but you have too little mass for the force to be very strong.

Gravitational force increases when the masses are bigger and closer. This means that the gravitational force on the Moon is less than on Earth because the Moon has LESS MASS than Earth.



Good examples of very massive objects that possess strong gravitational forces include the Moon and planets, too. Consider the Earth on which humans live. Everything tends to fall on the ground and stays there. If you jump, you came down again. Throw a ball upwards, and it will surely come down.



"Down" is towards the center of the Earth, wherever you are on the planet.

This is a result of gravitational force, which pulls objects towards the center of the Earth.

Questions:

1.) a. “The mass of an object is the _____on earth and in space (or other planets)”.

b. _____ is the amount of matter in something.

2.) a. What happens to your ***mass*** when you go from Earth to the moon? WHY?

_____

b. By how many times does your ***weight*** DECREASE when you go to the moon?

_____

3.) If two things are both on Earth, they will each have the same gravitational force. One has a mass of 100 grams and one has a mass of 200 grams - which one weighs more (has more gravity pulling down on it)? Explain your answer.

_____

_____

4.) a. “An object will have a greater weight if it has more _____.”

b. So this means that an elephant which has more mass than a mouse, should weigh more or less? Explain.

_____

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Part 2:

Directions:

a. ***Read** the first online article " The Shoulders of Giants"*
b. *Once you are finished reading complete the **questions** below.*

THE SHOULDERS OF GIANTS BY ROBERT CHESBRO

It is always there, but invisible. It holds you down, but you can't touch it. You'll never know a world without it, and you will never escape it. It is gravity. But for something so significant, do we really know what gravity is?

Legend tells us that the idea of gravity came to a man by the name of Isaac Newton in the 17th Century when he was bonked on the head by an apple. True or not, what is remarkable is that Newton basically reduced all observable phenomena to four key "laws" that still hold true today--everything made of anything follows these laws, and these laws cannot be broken.

One of these laws is the Universal Law of Gravitation, and it explains the nature of gravity with such precision that we have used it to send humans to the moon, orbit earth, explore Mars and the moons of other planets, as well as understand how stars and galaxies are born and how they die.

How many things around you are made of matter? A book, a cell phone, air you breathe, trees, a falling leaf, the earth, the moon, stars, you, and everything in between. Anything made

of matter has mass, and mass is a measurement of the amount of stuff in an object. In our universe anything made of stuff will attract anything else with stuff (gasp! Did I say "stuff" - whoa! I meant matter!)

This means that everything right in front of you is pulling on everything else. So, why doesn't it all lump together in a big pile? Because there is something nearby that has more mass than everything else--the Earth! The Earth has about one million billion billion times more stuff than anything else around, so it wins; and everything gets pulled toward *it*.

If you think of it through this lens of perception and then drop a tennis ball, you may see the effect of gravity in a new light--the object is not falling *down*; it is falling toward the *center* of the Earth where gravity is strongest…and the ground just gets in the way.

This force of attraction is what we call weight, and things have weight because they have mass. You have weight because your mass and the Earth's mass are attracted. If you step on a scale on Earth, it will measure that force of gravity pulling you towards the center of Earth, but your final weight depends on your location. For example: your weight would decrease just a little bit if you're using a scale on top of a mountain versus if you are standing in Medfield.

Newton's Universal Law states that two factors affect weight: mass of objects and the

distance between them. This means that weight can change. If two object's masses attract due to gravity, they will have a weaker gravitational pull if the mass of either or both is reduced. Because your mass is attracted to the Earth's mass this means that if

you eat less, get a haircut, or even clip your fingernails, the Earth pulls on you with less force because you have less mass and your weight decreases as a result!

Going to a planet or moon with a different mass than Earth's would also change your weight; although your mass always stays the same because you're always made up of the same amount of matter.

People often mistakenly believe that astronauts bouncing around on the moon are weightless. Although their weights are considerably less than when on Earth, they still have a force attracting them to the Moon; otherwise they would drift into space. The Moon's mass is about 1/6 that of Earth's, which means the attractive force between it and you would be 1/6 as much as on Earth. You would weigh six times less!

To put this in a more interesting way, a basketball hoop is 10-feet high. Michael Jordan, assuming he was not burdened by the extra mass of a space suit, could slam dunk a basketball in a hoop on the moon that was 60-feet tall using the same leg strength! If he were to try a slam dunk on Jupiter, he would have great difficulty getting off the "ground" because Jupiter's incredible mass would be crushing. This means that your weight would change if you voyaged from one planet to another.

If changing the mass of objects doesn't interest you, then you have more options if you want to conduct weight-loss experiments. Newton proved that the distance between objects affects the force of attraction between them. This means the farther away those masses are, the more weakly they are attracted. In this sense, gravity is like cell phone reception--the closer you are to the tower, the stronger the signal is.

So, this means that all you have to do is increase the distance between you and the center of the Earth and you'll lose weight! The next time you are on the top of a mountain or fly on a plane, you have lost weight. You could even stand on your chair and you lose weight. When people ask what you're doing, you can tell them you're testing Newton's Universal Law of Gravitation and conducting a weight-loss exercise!

Gravity is the mysterious force that holds our universe together and literally keeps our feet on the ground. Isaac Newton claimed that his insights came from the good fortune of standing on the shoulders of giants having benefited from the insights of the scientists that came before him. Perhaps there's a young Isaac Newton in your class at school, or maybe it's even you. Whatever the case, we can all learn from the world around us and stand on the shoulders of giants, and lose a little weight in the process.

Cool Fact #1: Your Weight on Other Worlds

Weight is a measurement of the force of attraction (gravity) between two objects, and it depends on the mass of the two objects and the distance between them. Check out how much a 100-pound person (on Earth) would weigh in elsewhere in the universe….

Earth:	**100lbs.**
Mercury:	37.8 lbs.
Venus:	90.7 lbs
The Moon:	16.6 lbs
Mars:	37.7 lbs.
Jupiter:	236.4 lbs.
Saturn:	106.4 lbs.
Uranus:	88.9 lbs.
Neptune:	112.5 lbs.
Pluto:	6.7 lbs.
The Sun:	2,707.2 lbs.

A White Dwarf: 130,000,000 lbs.
A white dwarf is a small star with a mass equal to that of our sun, but with a volume the size of Earth
Neutron Star: 14,000,000,000,000 lbs.
A neutron star is an extremely hot star resulting from the collapse or explosion of a larger star. It is made up of sub-atomic particles called neutrons.

Cool Fact #2: Slam Dunk Contest!

A standard NBA basketball hoop is 10-feet from the floor of the court. Check out how high hoops could be for an out-of-this-world slam dunk contest! If this is too tricky to understand - don't worry about it, it's a "just for fun" fact.

Mercury: 27 ft.
Venus: 11ft.
Earth: 10 ft*
The Moon: 60 ft
Mars: 27 ft.
Jupiter: 4. 2 ft
Saturn: 9 ft
Uranus: 11 ft
Neptune: 9 ft
Pluto: 149 ft

Questions *(remember to use complete sentences!):*

1. *What is the definition of weight?*

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2. *Why does everything on Earth get pulled towards Earth and not towards space?*

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3. *How does our weight change based on location?*

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3. *Describe the difference between Mass and Weight?*

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