VIRTUAL TRIP TO THE MOON

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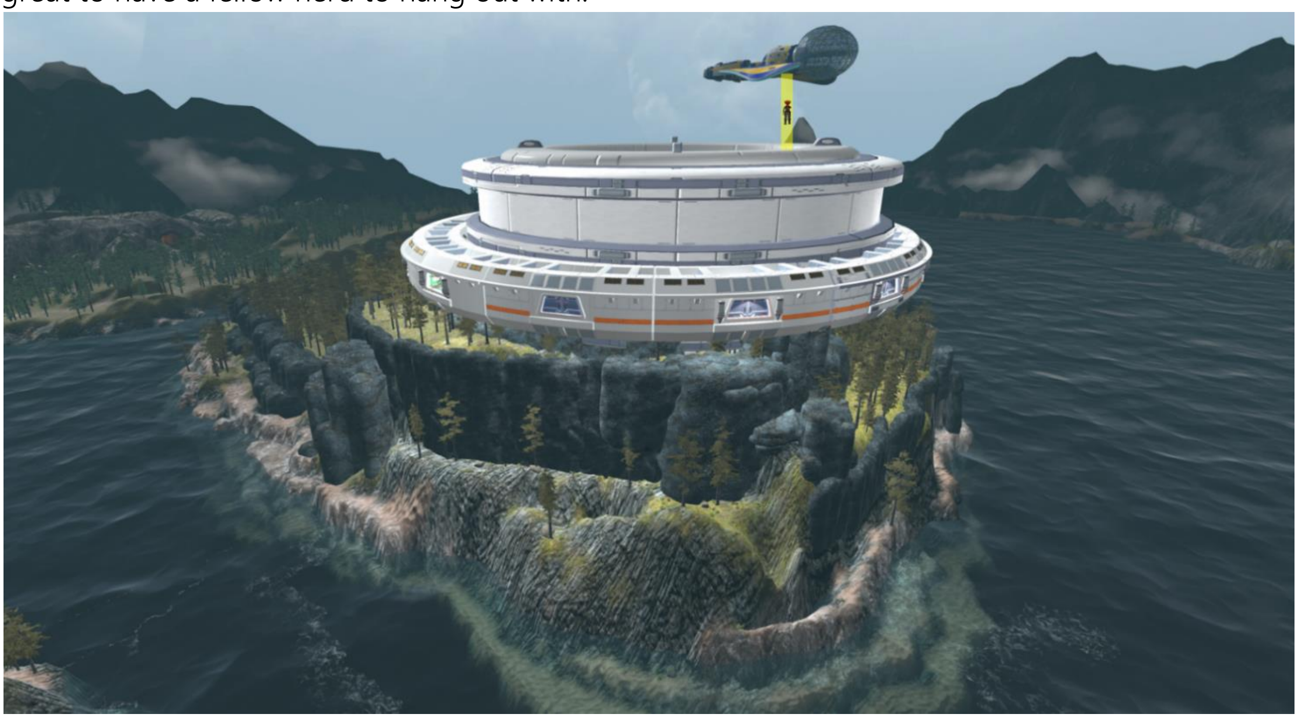
JACKSON'S STORIES

VIRTUAL TRIP TO THE MOON (AS TOLD BY JACKSON)

I am really psyched about the contest, but the news from California is not great. One of the kids in my lab got Covid, so now all the kids in that class are quarantined for fourteen days. So, I am home full time with Johari. The temperature is still topping the hundred degree mark most days, and Johari is driving me batty. She is either complaining about her boring online classes, or she is singing. Yeah, she has decided she is going to be a singer, and Mom is encouraging her and even got her a coach that she visits online. She has always been the favorite child. I am really thankful for the contest distraction.

All of the *Cosmic Explorer* kids are going to do the *Virtual Trip to the Moon*. Grandpa is going to come too. The objective of this mission is to travel to the Moon and find out what it is like. We have to measure the size, weight, acceleration of gravity, density, temperature, and composition of the atmosphere and land. We have to submit a report on our mission that will be used to determine if we get into the *Regionals*.

I'm not bragging, but I already know this task will be pretty easy. I did most of those calculations with Neddy out of curiosity while we were on our actual trip to the Moon. It was great to have a fellow nerd to hang out with.



We started our mission at 9:00 a.m. my time, which was twelve noon for everyone on the East Coast. We all logged in to the *Virtual World*, went to the *Mystery Museum*, and teleported to the *Cosmic Egg*.

The kids agreed that I would be the leader for this mission. "OK, who picked the role of *Navigator*?" I asked the crew.

"That's me," answered Lizzy.

"You have to program your computer to take us to the Moon," I instructed her.

"Aye, aye, sir," she agreed with a dramatic salute. "I'm on it."

Soon, we were on our way. At some point, Richie asked us all, very seriously, "Did you guys hear about the bones they found on the Moon?" After a pause he answered, "The cow didn't jump high enough." Then he burst into annoying laughter.

It brought groans from the rest of us, and unfortunately the Moon jokes kept coming.

"What holds up the Moon?" Neddy asked.

"It's moonbeams," answered Lizzy.

"How do you know when the Moon is going broke?" asked Milo. Without waiting for an answer, he said, "When it's down to its last quarter."

Even Grandpa contributed. "Did you hear about the new restaurant on the Moon? The food is great, but there's no atmosphere."

Thankfully, we arrived at the Moon before anyone else could add their two cents. Virtual travel is much faster than real travel, so we were there in less than ten minutes instead of the two days for the real trip. The actual travel time was less than one second. It took five minutes to speed up and five to slow down. I was using virtual-reality goggles instead of my computer screen. As I looked out at the vast blackness of empty space, it seemed like a very lonely place to be. Our beautiful planet is like a lively theme park in that lonely space.

We had one problem. All the clone pets that Neddy and Richie had created apparently continue to follow their creators all over the *Virtual World*. It turned out that Milo had one also. It was from a date he went on with Svetlana in *Mission KT*. So, they were all there with us on our trip to the Moon. We had three miniature Triceratops, a Titanosaurus, and a T-Rex. They were cute, but just like Milo and Svetlana discovered, they are pains in the butt. They keep bumping into us. So, we locked them in the utility room. Neddy's T-Rex pet, Rexy, and another dinosaur named Topsy didn't like that. They made a terrible racket. We let them out to hang with us in the main cabin. We'll ditch them when we teleport to the surface of the Moon.

"Hey, kids," asked Grandpa, "do you mind if we go back in time? I was at NASA when they took the famous picture of Astronaut David Scott saluting the American flag. I would like to be on the Moon to see that."

Everyone thought that was a cool idea, so we went back to the date Grandpa wanted: August 1, 1971.

"Let's make some circles around the Moon like we did on our real voyage," I suggested when we got close. "We can look for the NASA landing site, and our *Navigator* can measure the Moon's circumference." The most disappointing thing about our real trip was that we just circled and didn't get to go to the surface.

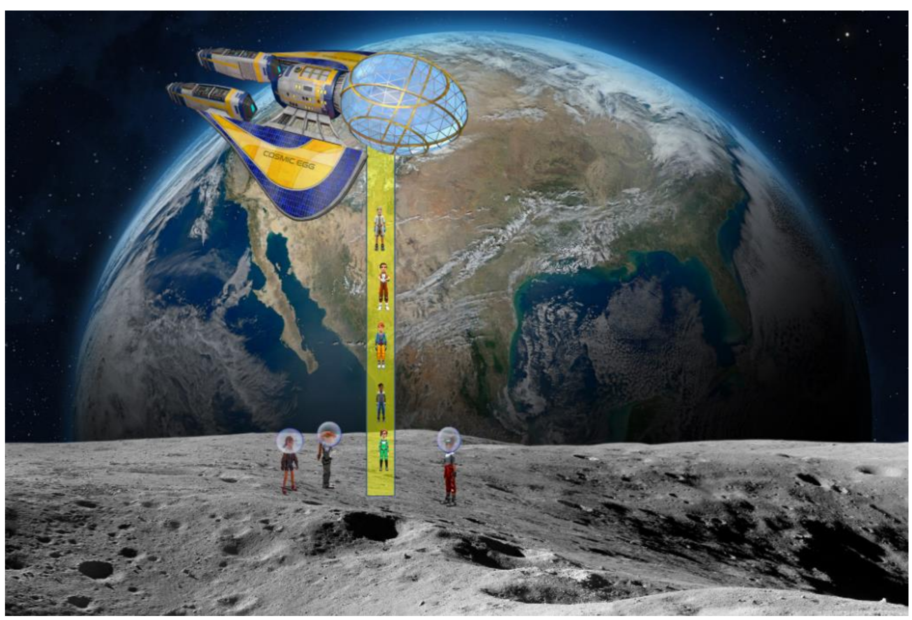
Lizzy finished piloting the ship for the first circle and reported, "The circumference is 10,920 kilometers. So, the Moon is about four times smaller than the Earth."

On our second circle, VC pointed and called out, "I see the NASA landing site."

The whole crew rushed over to look. The *Moon Lander* glinted in the rising sun.

We hovered over the landing site and were almost ready to go down to the surface.

As the mission leader I am also the safety officer. So, before we teleport to the surface, I have to make sure it is safe.



I was concerned about the temperature at the surface near the proposed landing site. I had been checking the surface temperature while we circled. It was hotter than boiling water in the direct sun and minus 130 degrees Celsius in the full dark. "It looks like the 1971 landing site temperature is OK," I announced. "Fortunately, it is in the area of sunrise."

I had Neddy, who was our *Scientist*, check the composition of the atmosphere. "Grandpa is correct about the Moon restaurant," she reported. "There is no atmosphere. There are some molecules of oxygen, nitrogen, and other gases, but they are a billion, billion times fewer than they are on Earth. We won't be able to breathe. So, we'll have to use our helmets."

"OK gang," I said, "start planning how you are going to do your measurements. Neddy already did the composition of the atmosphere, and I did the surface temperature. We have the Moon's circumference also. Now we just need to measure the weight of the Moon, its density, its acceleration due to gravity, and the composition of the surface."

"Let's go," said Johari. "This is going to be the new GOAT." We all teleported to the surface.

"OK, everyone," I announced in my leader voice, "get going with the measurements of the Moon's properties."

"Hey Guys," Lizzy interrupted excitedly, "I can already tell that the Moon's force of gravity is way less than on Earth. Look how high I can jump. The Moon is much smaller than Earth, so it's pull on me is much smaller. VC and I will measure the acceleration due to gravity with my *Velocity* tool. VC can drop a rock, and I will measure the velocity change as it falls. VC will use a stop watch so we know the time it takes for the fall. That will give us the acceleration due to gravity on the Moon."

"I bet I can get the result faster," I challenged.

"You're on," Lizzy accepted. She and VC started making their measurements.

"Hey, Milo, I asked, "how much do I weigh?" Milo was the *Guardian* and had the *Mass and Weight* tool.

"Ten kilograms. That's twenty-two pounds," he answered.

I did a quick calculation in my head and announced, "The acceleration due to gravity is 1.6 meters per second per second. I win."

Ten minutes later, Lizzy and VC completed their velocity measurements. "OK, *Boy Genius*," said Lizzy, "how did you get the answer so fast? We got about the same value."

"Milo measured my weight on the Moon as ten kilograms," I explained. "On Earth, I weigh sixty kilograms. So the force of gravity on the Moon is one-sixth of that on Earth." VC looked impressed so I kept going. "If the force of gravity is one-sixth, then the acceleration due to gravity is one sixth also. That is because the acceleration (a) of an object equals the force on the object (F) divided by the mass of the object (m). That is Newton's famous second law of motion, F=ma or a=F/m. So, one-sixth of the 9.8 meters per second per second acceleration on Earth is 1.6 meters per second per second on the Moon."

"OK," said Lizzy patting my shoulder, "*Boy Genius* gets to keep his title."

"Hey, kids," Grandpa said, "how about visiting Astronaut Scott?"

We all started walking in the direction of the Moon Lander that we could see in the distance.

We arrived on the scene to see Colonel David Scott saluting the flag. Grandpa put his hand over his heart too. Us kids were a little more hyper, but Colonel Scott didn't seem to mind. He paid no attention to us even when Milo and Lizzy took advantage of the low gravity to jump over his head.

Neddy, as the *Scientist,* was busy measuring the composition of the Moons surface. "It has a lot of the same elements as on Earth, but not exactly," she reported.

"It makes good sense that the Earth and Moon should be similar," added Grandpa who had finished saluting the flag and was back to helping us. "The theory of the Moon's origin is that it formed from the debris kicked up when a huge asteroid hit Earth. So its composition should be a combination of Earth and the asteroid."

"OK," I said. "Two more things we have to determine are the mass of the Moon and its density." We made the measurements and put them in a report at the end of the *Journal*.

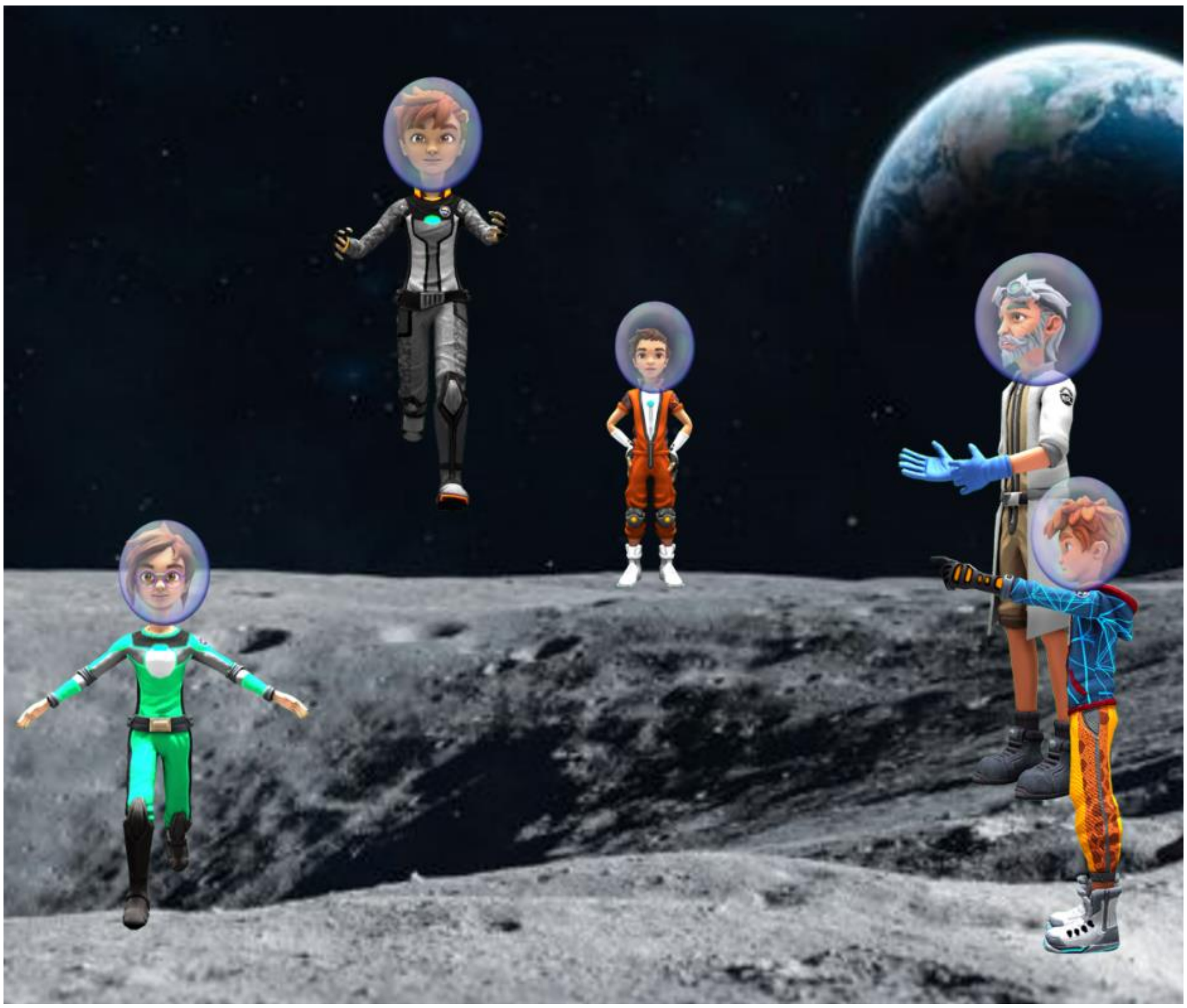
"Let's see if our measurements are consistent," I said. "Let's compute the mass of the Moon by using the formula: *Mass equals Density times Volume*. We can compute the Moon's volume from the circumference that we measured."

We got the same seventy-three billion trillion kilograms. We put the complete Moon mass calculation at the end of the *Journal*.

We had one more job to do. We had to measure the period for one full revolution around the Earth. We left the *Cosmic Egg* in place as our marker and advanced the time. It took 27.3 days for the Moon to circle the Earth and arrive back at the starting point below us.

We had finished our assignments. We would now have to put our findings together in a report for the contest judges.

Before ending the mission, we spent the next hour exploring the Moon and jumping over craters. Lizzy was able to do the biggest jump. So she is the crater-jumping champion as well as the gin rummy champ.



"I have a question," Richie said. "There are all of these craters covering the Moon's surface. Why don't we see the same thing on Earth?"

"That's a good question," replied Grandpa. "There are a bunch of reasons. Smaller meteors burn up in Earth's atmosphere and never reach the surface. Some asteroids hit the water, like the one that killed the dinosaurs. You don't see any of the craters that slam into ocean floors. Some craters are destroyed by erosion or hidden by plant life. But there are lots of craters if you look for them. One of the best is the Barringer Meteorite Crater in Arizona. It is over a kilometer wide."

Grandpa asked if there were any other questions, but nobody had any.

"OK," I said, "great job, everyone. Our next mission is the Survey of the Solar System to find peculiar things. That should be interesting too."

GRANDPA'S GLOSSARY

Virtual World: Virtual worlds, also known as virtual environments, use computer technology to create a simulated world that a user can explore and interact with, while creating a feeling as if he or she were in that world. The representation of the user in that world is called an avatar. The user can even wear goggles to make it appear that he or she is surrounded by the 3-D virtual world. That is called virtual reality.

Cosmic Egg: The Cosmic Egg is the fictional ship in the *Virtual World* that is used for Time-, Space- and Size-Change traveling anywhere in the universe at any time.

Acceleration due to Gravity: Gravity is a force of attraction between all physical objects. If an object on Earth is dropped or thrown, the force of gravity between Planet Earth and the object will cause it to accelerate toward Earth. On Earth, the acceleration (rate of change of velocity) due to this gravitational force is 9.8 meters per second per second. That means that the velocity changes by 9.8 meters per second every second. The acceleration due to gravity on the Moon is one sixth the value on Earth. The value depends on the mass and radius of the Earth or Moon.

Force of Gravity: Gravity is the weakest of the four fundamental forces of nature. It is a force by which all things with mass (including ordinary objects, atoms, planets, stars, and galaxies) are attracted to one another. On Earth, gravity's pull on an object gives it weight. Gravity has an infinite range, although its effects become increasingly weaker as objects get further away. First Galileo and then Sir Isaac Newton predicted the inverse-square law of gravitation (the force is proportional to 1 divided by the distance between them squared). Newton proposed the following equation:

$$F = G*m(1)*m(2)/r^2,$$

where F is the force between two masses, m(1) and m(2); r is the distance between the centers of the masses; and G is the gravitational constant.

Gravity is more accurately described by the General Theory of Relativity proposed by Albert Einstein. Even light is affected by gravity in Einstein's theory.

Moon Mass Calculation: The circumference of the Moon is 10,920 kilometers. The circumference is $2\pi r$, where r is the radius of the Moon and π=3.14. With the volume equal to $4/3\ \pi\ r^3$, we get the volume of the Moon as 2.2×10^{25} cubic centimeters. Using the measured density of 3.34 grams/cm^3 and the formula mass=density x volume, we get 7.35×10^{25} grams or 7.35×10^{22} kilograms for the Moon's mass. This is the same value as the known mass.

Barringer Meteorite Crater: This crater, located in the Arizona desert, is a well-preserved 50,000-year-old impact feature. It is 1.2 kilometers in diameter and 170 meters deep. The rim of the crater rises 45 meters above the desert floor. It was formed when a large meteorite hit the Earth.