

WORLDS OF CURIOSITY

Final Script

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FADE IN:

1 EXT. MINECRAFT GAME CAPTURE 1

DR. ALICA WOODS (35) is building a habitat on one of the WHIMC servers. Title flies past Camera. Camera flies into the habitat door as we hear the sound of a video call ringing. The shot pauses with the Minecraft pause screen.

CROSS-FADE:

2 EXT - SPACE 2

We orbit around the Sun past the orbit of Neptune. Video call windows for Dr. Woods and MATEO (10) open over the Solar System background.

DR. WOODS

Hello, you've reached your local planetarium's video hotline. You've got a question, I've likely got an answer!

MATEO

Hello, this is Mateo.

DR. WOODS

Nice to meet you, Mateo! I'm Dr. Alicia Woods. I study the solar system. What can I help you with today?

Orbit lines for planets fade in behind characters.

MATEO

So, I was watching this show that said Uranus spins on its side. That seemed weird, so I asked my brother, but he just made a joke and wouldn't stop laughing. Can you tell me if it's true?

Fly-in to Uranus as Mateo is asking his question.

DR. WOODS

Yup, Uranus is tilted more than 90 degrees off of vertical, making it a real oddball. We think that, in its early years, something really big collided with it and tilted it. That's likely where its cute little ring came from, too.

Overlay on Uranus shows the angle of the pole relative to the orbit path.

MATEO

(quietly/musingly)

That's so weird. I wonder what it would be like to live there.

DR. WOODS

That's a really great question, I have no idea. Let me share my screen and we'll go find out.

MATEO

What?!

VR RANDOM BLOCKS:

2.5 TRANSITON EXT - MINCRAFT SCENES IN BLOCKS **2.5**
Minecraft like command window opens and load and run world commands are entered.

VR RANDOM BLOCKS:

3 EXT - SPACE **3**
We fly around in view of the Sun and Earth Orbit. As Dr. Woods talks, we enlarge the Earth and Sun and show how the location of the shadow of the Sun changes throughout the year.

DR. WOODS (VO)

Let's see, if Earth was on its side... Well, the obvious difference would be the change in the motion of the Sun

during the year and therefore the seasons.

MATEO (VO)

I thought the seasons came from how close we are to the sun.

DR. WOODS (VO)

That's a pretty common misconception. Our distance from the Sun only changes 3 percent throughout the year, which isn't enough to make a big difference in temperature. Plus, we're closest in January. Instead, it's the amount of sunlight from day to day and how high the sun passes through the sky that's behind the change in temperature. There isn't a lot of sunlight during winter, so it's cold, and during the summer, the sun is up higher in the sky for a longer duration of time so it gets much warmer.

MATEO (VO)

But if it's not the change in our orbit that changes the amount of sunlight we get, then what does?

STRAIGHT ON VIEW OF EARTH

Graphic overlaying the pole, orbital plane, and tilt angle. Earth tilts from pole vertical to pole 23.5° to the right.

DR. WOODS (VO)

Our tilt! Earth's north pole doesn't point straight up, but instead 23 degrees to the side. It's all about sight lines. Think of the sun as creating a circle of light.

BACK TO ORBIT VIEW

DR. WOODS (VO)

You can see the north and south poles of earth. Now, as the Earth orbits the Sun, there will be a time of the year when one pole is fully lit by the sun while the other pole is in total darkness.

MATEO (VO)

Okay... so the tilt changes where the poles cross the circle?

DR. WOODS (VO)

Exactly. We have summer in the northern hemisphere when the north pole is the most in the circle. The southern hemisphere has winter then because they're being tilted farther out of the circle.

STRAIGHT ON VIEW OF EARTH

Graphic overlaying the pole, orbital plane, and tilt angle. Earth tilts from pole vertical to pole 90° to the right.

MATEO (VO)

So if the Earth was tilted like Uranus... the north pole would be closer to the middle of the circle, pointed at the sun for part of the year, and later the south pole would point towards it, right?

BACK TO ORBIT VIEW

DR. WOODS (VO)

Yes, exactly! In spring, the Sun would be over the equator and as we orbit, it would get higher and higher in our sky, until it would be directly over the north pole. The northern half of Earth would have continuous daylight! No nights.

Overlay VFX temperature scale with North and South pole sliding temperature indicators.

MATEO (VO)

That would be so hot!!

DR. WOODS (VO)

110 degrees Fahrenheit at the north pole to be precise.

MATEO (VO)

Ew!!

Pole temperature indicators slide back and forth as Earth orbits the Sun.

DR. WOODS (VO)

Then the Sun would start lowering in the sky until six months later, it would be directly over the south pole.

MATEO (VO)

Does that mean the people in the north wouldn't see it at all?

DR. WOODS (VO)

Very good! There would be months of continuous night and bitter cold. It would be brutal. Negative 100 degrees Fahrenheit at the pole in darkness.

Georgia would get as cold as the tundra, can you imagine?

MATEO (VO)

I would really rather not.

DR. WOODS (VO)

Yeah, everyone would probably live somewhere near the equator on that version of Earth. The equator would stay relatively normal, though it wouldn't be tropical all year round like it is now. That's a lot less land to live on though--nearly two thirds of Earth's landmass would be buried in snow and ice for months.

CROSS-FADE:

4 EXT - NIGHT SKY WITH MOON

4

Video call windows fade-in over the night sky background.

DR. WOODS

Wow, that was fun. Come on, let's do another one. What other questions are you curious about?

MATEO

(hesitant, but excited)

Um...I've always wondered about the moon, I guess. Why it's there, and what if it wasn't.

Moon pops out of existence.

DR. WOODS

Oooh, no moon, that's a good one. Let's check it out!

CROSS-FADE:

5 EXT - SPACE, FACE-ON VIEW OF EARTH 5

Graphic overlaying the pole, orbital plane, and tilt angle. The Moon fades out, then Earth tilts from pole 23.5° to the right to pole vertical.

DR. WOODS (VO)

Ok, so if there's no moon, that means that the giant collision that made it and tilted the Earth also never happened, so the Earth would rotate vertically.

MATEO (VO)

So, we wouldn't have seasons at all?

EARTH ORBIT

We see the Earth orbiting the Sun oncemore, with the North Pole perpendicular to the orbital plane.

DR. WOODS (VO)

Correct! The amount of sunlight would never change, so the poles would always be cold and wintery, and the equator would always be hot and summery.

MATEO (VO)

Would tides still exist? In the last chapter, my textbook said the Moon controlled the tides.

VFX overlay of cartoon animation of tides. Shows how tides from the Moon are larger in magnitude than tides from just the Sun.

DR. WOODS (VO)

The Moon determines how high they'll get, yes. The Moon generates about two thirds of our tides today, while the Sun is responsible for the other third. Since the Sun still exists in this

scenario, we would still have tides.
They would be smaller though. Oh!
Smaller tides would also mean the Earth
would spin faster.

Fade overlay and the Earth starts spinning faster in
its orbit around the Sun.

MATEO (VO)

(incredulously)

I'm sorry, what? Are you saying the
tides...what, slow the whole planet
down?

DR. WOODS (VO)

Well, think about it. All the water in
all of the oceans - and the Earth is 75
percent water remember - sloshing back
and forth. That drags on the ocean
floor, and just like it's hard for you
to walk upstream in a river, it's hard
for the Earth to spin against that, so
our Earth has slowed down from its
original speed.

But this Earth here with no Moon
wouldn't have had to fight as hard
against its tides, so it would be
spinning a lot faster, probably closer
to what it was doing back when it first
formed.

VFX overlay of Minecraft-like command window, where we
see Dr. Wood's calculation being done.

DR. WOODS (VO)

So, let's see, the day would be... like,
8 hours, with the sun up for only about
3 to 5 of those.

MATEO (VO)

(as if he is doing the math in his head)
 Okay so... we could fit three of those
 days into just one of ours?

The clouds thicken on Earth and it gets very windy.

DR. WOODS (VO)

Yeah, weird, isn't it? That's a shorter
 day than Jupiter. Jupiter's day is 10
 hours long. And the really wild thing
 is that how fast we spin changes what
 the wind does, so we would look a bit
 like Jupiter too. There would be
 insanely fast winds, like hurricane
 strength, everywhere. 100 miles an hour
 would be the average, not an extreme.

MATEO (VO)

I don't want to live in a constant
 hurricane.

DR. WOODS (VO)

Yeah, it would be much harder to live
 here without the moon.

MATEO (VO)

Aaahhh, that's so cool!

VR RANDOM BLOCKS:

5.5 TRANSITON EXT - MINCRAFT SCENES IN BLOCKS 5.5

VR RANDOM BLOCKS:

6 EXT - NIGHT 6

The night sky slowly moves overhead. The video call
 windows fade in over top of the sky.

DR. WOODS

You know, you ask great questions.
 These are the kind of questions that
 push science forward.

MATEO

Nah, this was just playing around.

DR. WOODS

But, that's what science is.

MATEO

No, it's not. Science is all serious and running experiments.

DR. WOODS

What's an experiment but asking a "what-if", building a scenario around it, and then testing it to see if it's true? We just did that. We asked a what-if question and then figured out the consequences, like following a trail of breadcrumbs. Or knocking over dominos.

Particles of light fly past the camera, eventually forming a picture of Einstein.

DR. WOODS

Here, let me give you an example. Have you heard of the theory of relativity?

MATEO

I think so. Einstein made it, right?

DR. WOODS

Yup! You've probably seen this equation around. It's from Einstein's theory of relativity, that mass and energy are basically the same thing.

Part of how he came up with the theory that changed all of physics was asking himself the question, "If I were to run alongside a beam of light, what would I see?"

MATEO

Isn't light the fastest thing in the universe? That would be insanely fast.

DR. WOODS

Nearly three seconds to the Moon and back. Einstein sat in his armchair, and thought it through just like we did, and presto! Relativity was born!

MATEO

WOW!

Picture fades out.

DR. WOODS

Science, big and small, is full of thought experiments like this. Like, "What if I mix baking soda and vinegar?"

MATEO

Oh, yeah, I haven't done that one, but I have done Mentos in Coke before. I made a mess, don't tell my mom.

Apples fall onto the dome.

DR. WOODS

Your secret's safe with me. Oh, and Isaac Newton is famous for asking "What if why an apple falls is also why the Moon moves?"

MATEO

And so he discovered gravity.

Movement of the night sky stops and images of the large and small Magelenic clouds zoom-in.

DR. WOODS

Exactly! And it wasn't until the 1920s that galaxies were even determined to be galaxies. They were thought to be nebulae in our own galaxy until someone asked, "what if these blobs are outside the Milky Way?"

Video call windows fade away.

MATEO (VO)

Wait, we've only known about galaxies for a hundred years? That's not even that long ago!

CROSS-FADE:

7 EXT - SPACE

7

Angled view of the Milky Way Galaxy, slowly orbiting around.

DR. WOODS (VO)

Mmhmm, we're constantly learning new things, asking new questions. What we did here, with your questions about a tilted Earth or Earth with no moon, that was just exploring other planetary options. Scientists have always asked questions like these:

MONTAGE OF HOT JUPITER, BIGGER EARTH, AND EARTH WITH TWO SUNS

DR. WOODS (VO)

What if Jupiter was closer to the Sun?
What if Earth was bigger? What if we had two suns?

MATEO (VO)

Have we found the answers to those questions?

DR. WOODS (VO)

Some of them. But it turns out the universe is a pretty weird place, and in searching for the answers, we've found even stranger planets.

MONTAGE OF WATER WORLD, LAVA WORLD, DIAMOND WORLD, AND EYEBALL WORLD

DR. WOODS (VO)

There are planets completely covered in water, or even more awesome, lava. There are planets made mostly of diamond. There are planets that, through this weird trick of gravity, rotate so slowly that the same side always faces their star, making them into "eyeball worlds". Catchy name, really, I like those ones.

MATEO (VO)

What, I don't understand. What's an eyeball world? Why are they called that?

DR. WOODS (VO)

(enthusiasticly)

I'm glad you asked! Because the same side always faces their star, that side would always be hot and the other side cold, with a ring of middling temperature between. They would look something like this, which kinda looks like an eyeball, don't you think?

MATEO (VO)

I guess...yeah, a little bit.

CROSS-FADE:

8 EXT - SPACE**8**

Orbiting the Milky Way again. Video call windows fade-in over top.

MATEO (VO)

Wow. I guess my questions really are science!

DR. WOODS (VO)

Absolutely! Science is honestly driven by your imagination. How would we ever discover anything if we didn't think to ask the question? So keep asking "what if" questions no matter how weird or difficult you think the answers might be.

Fly-in to Milky Way with Minecraft world blocks fading-in.

DR. WOODS (VO)

Speaking of weird questions, do you want to go explore one of those planets?

MATEO (VO)

What? Don't I need a rocket? My allowance isn't big enough for that.

DR. WOODS (VO)

No rocket required. We've built it!

MONTAGE OF MINCRAFT WORLDS

MATEO (VO)

You built a whole planet?

DR. WOODS (VO)

Well, virtually. Do you play Minecraft?

MATEO (VO)

Yeah, I build stuff in there all the time.

Worlds show as Dr. Woods lists them.

DR. WOODS (VO)

Awesome, we've got all kinds of planets like the ones you asked about—no Moon, colder sun—even a few of the new exoplanets that have been discovered recently.

MATEO (VO)

Oh, wow, that looks like fun. I love playing Minecraft.

DR. WOODS (VO)

C'mon, let's go exploring!

Credits roll on top of the remaining Minecraft montage.

FADE-OUT