mystery science

Grades K-5
Mini-Lesson: “Why can't airplanes fly to space?”

VIDEO TRANSCRIPT

VIDEO 1

Hi, it's Doug! Back in December 2018, the company Virgin Galactic made history when they successfully flew the first plane all the way to the edge of space. Called the VSS Unity, it wasn't exactly an airplane, though. You can see here, another plane first carried it up really high, then let go of it. And you can see, it's got this rocket engine it fired until it got to space. The VSS Unity is what people are calling one of the first space planes. What about airplanes, though?

Someone named Jared has a question about this. Let's give him a call now.

> **[Video Call]**
> - Hi, Doug!
> - Hi, Jared!
> - I have a question for you. Why can't planes fly to space?
> - That's a great question.

All of the astronauts who go to space get there using a rocket. And yet, airplanes do go really high, so why don't we use planes to get to space? To figure this out, we need to know more about how a plane flies at all. I promise, once you understand how an airplane flies, I think you'll be able to easily figure out why airplanes can't fly to space. So, we'll come back to the question of space at the end. First, let's talk about how an airplane flies at all. And when you stop and

think about that, it's actually pretty amazing, isn't it? Think of just how heavy an airplane is. Why wouldn't it just fall out of the sky? There's a clue, and it's something you have to try for yourself. Next time you're in a car going fast, like on the highway, and the windows are down, try holding your hand out, but not just sticking your hand straight out—instead, at a tilt, like this. Now, obviously, you wouldn't want to stick your hand out if there are cars very close to you going past. Make sure your parents are supervising. But give this a try. If you've ever tried this before, you'll feel what happens. As soon as you tilt your hand, it starts to get lifted up. What's going on here? Why does tilting your hand make it suddenly start to lift? What do you think?

VIDEO 2

Here's the thing to notice: When you put your hand out the window, at first, if you have it straight like this, air just goes around your hand. But as soon as you tilt your hand, now some of that air bounces off your hand this way, pushing your hand up as it does. You may not have any experience flying an airplane, but it's the same basic idea when you fly a kite. Notice how a kite, too, is tilted. If it's a windy day, the air hits the bottom of the kite and bounces off the bottom, lifting the kite up off the ground. That's what makes a kite fly. So, next time you see an airplane, have a look. What do you notice? The wings are tilted. Of course, being tilted alone isn't enough. There has to be wind that's hitting the wing. Check out this video of an airplane just sitting on a runway during a windstorm. There's no one even on board this plane. In fact, they've got it roped down so that it won't take off. You can see why. Each time a gust of wind comes by, it lifts the plane up. It's the tilt of the plane's wings that pushes the wind downwards, lifting the plane off the ground. Now, obviously, when you want to fly in an airplane, it's not that you just have to sit there and wait for a windy day. So what if there's no wind? Well, it's helpful to think again of flying a kite. On a day with no wind, you can still make the kite lift up by running along

the ground. By running, that pushes the kite forward through the air. What you're doing is creating wind that hits the kite. Well, a plane is no different. It doesn't have to be a windy day to fly. That's what a plane's engines do. A plane's engines constantly push the plane forward through the air. They create wind that hits the tilted wings. Because the wing is tiled, as the air hits it, it pushes up on the plane. But what about the fact that planes are so heavy? This Boeing 747, for example, weighs the same as 50 elephants. The amazing thing is, there's really no limit to the amount of weight that can be lifted, as long as the engines create a strong enough wind. Check this out. They've placed an empty van right behind this giant plane to give you a sense of the incredible power of its engines. Look at this; whoa! Now you can understand why airplanes can't fly to space. The higher up you go in Earth's atmosphere, the less air there is. By the time you reach space, there's no air at all. Even if a plane had the most powerful engines in the world, those engines are useless if they're not pushing the plane forward through air. So the name “airplane” really is a great name for what it is. Airplanes can't stay up in the air without pushing air downwards. Just so you know, the tilted wings of most large airplanes is definitely not the only way to push air downwards. There are other types of wing designs that can do this too, but all of them work using the same basic idea.

That's all for this week's question. Thanks, Jared, for asking it.