Gravity Compilation: Crash Course Kids
Compilation
https://youtube.com/watch?v=EwY6p-r_hyU
https://nerdfighteria.info/v/EwY6p-r_hyU

=====Defining Gravity (0:00)=====

What goes up must come down: a ball you throw in the air, an apple that drops from a tree, even you, when you're on a trampoline at someone's awesome birthday party -- but why? My friends, let me introduce you to one of the most wonderful forces in the universe. It's one we're all experiencing right now, without even trying. Fasten your seat belts, because we're going to explore the power... of gravity!

If I told you that you just won the lottery what would you do? If you're like me you'd jump up and down and scream! And after you were done freaking out and jumping in the air, you'd land on your feet, right?   But why would you land back on the ground instead of just floating off into space?   [text: Big Question]
It's because of a little something we call gravity. Gravity is what pulls everything toward the ground, including you. Without the force of gravity, there would be no life on Earth. Air, water, animals, everything would fly off into space. There'd be no you, no me, no french fries, nada.   Think of gravity like the invisible super glue that holds our massive world together. You can't see it but it's always there. An English scientist named Isaac Newton was the first person to seriously study gravity, over 300 years ago. There's a famous story about him that you might of heard. Supposedly, Sir Isaac was hanging out underneath an apple tree, thinking, probably partly napping, when an apple fell from the tree and conked him on the head.   That's when Sir Isaac had an Ah-ha moment. Why did the apple fall down to the ground, and not up, or sideways. He realized that a spacial kind of force, which we now know is gravity, was acting on all of the objects on Earth, pulling them toward it. Once the apple became too heavy for its stem to hold it any more, the gravitational pull of Earth brought the apple down onto Newton's noggin. Newton's also realized how heavy an object is either. Whether you are holding an apple, a bowling ball, or a feather, you let go of it that sucker is going down.   We're gonna make a whole video about this later, but basically he determined that what goes up, must come down. Sir Isaac was a pretty smart dude.   Okay, so you know that if you jump up, you'll eventually land back on the ground. And you know that apple dropped down will land back on the ground too. But what if you throw something in front of you? Or to the left? or the right?   [text: Investigation]   To see how gravity will act, pick up a tennis ball or any small round object and hold it in your hand. Let's toss it in the air and watch it fall to the ground. No surprise here. Okay now pick it up and hold it over you head and watch it fall once more. Again not a shocker. Now throw it to your left, ball down. Pitch it to the right and watch it go down again.   [text: Conclusion]   No matter where you throw the ball, it's going down. So we've determined that near the surface of the Earth, where we all are, gravity is the cause the produces the effect of all unsupported objects falling down. The ball will go up or to the left or to the right for a little bit but eventually it's going to be pulled back down to the ground no matter what. Gravity's got a hold on, well, everything.

So eventually, everything that you can think of can be thrown up into the air and will come back down even if you throw it to the left, to the right, or any other direction. That's gravity doing its thing. But when you really think about it, which way is down anyway? I mean, the Earth is round, and there're all kinds of things on what we think of as the bottom of the Earth. So how does gravity keep them from falling off? I know a penguin who can answer that question!
=====You're Down To Earth (3:47)=====

So. You know that the Earth is round. And you know that gravity is the force that pulls objects down. But if the Earth is round, and there's stuff at the bottom of the Earth, say, a penguin in Antarctica. Why doesn't gravity pull the penguin down, off of the Earth? I mean, does gravity really pull down?   [text: Big Question]   When we talk about gravity and we say things like up or down, we don't mean those things in the sense that you're used to. In this case, 'up' just means away from the Earth, and 'down' means toward it. So when you hear people say gravity pulls things down to Earth, they really mean that gravity pulls things toward the Earth.   Now think of it this way. Gravity is the force of attraction between any two objects made of matter, right? Well, I have news for you: you're made of matter, and so is the Earth.   That means you and the Earth have an attraction to each other. Aww, you guys! Anyway, the scientific argument for gravity is that any object that's on or close to Earth's surface, and is made of less matter than Earth, will be pulled in by our planet's stronger gravitational pull. Wanna do a little demonstration?   [text: Investigation]   To show how Earth's gravity can pull an object, like the penguin we mentioned before, toward it, no matter where on Earth that penguin is, all you need is a tennis ball and a rubber band. Oh, and your index finger.   Now, let's pretend the tennis ball is Earth, and the rubber band represents the force of gravity. That makes you finger our adorable little penguin, just chilling on the surface of the Earth.   Now, stretch the rubber band around your tennis ball Earth, and stick your finger under the rubber band. Now try to lightly pull your finger away from the ball. The penguin is trying to jump off the Earth.   Even though penguins can't fly! What are you doing, penguin? But, what happens? Not much. Your finger doesn't get far before the rubber band pulls it back toward the ball, right? And the effect is the same no matter where your finger penguin is on your Earth ball.   Whether it's at the top, or the side, or on the very bottom, the same thing happens. The penguin is forced back to Earth, no matter how hard it tries to jump off. So, what does this mean?   [text: Conclusion]   It means that no matter where on Earth an object is, the planet's gravitational pull will draw the object toward it, and that's how you should think about gravity. It's the force that pulls things toward Earth.   So basically, we have gravity to thank for the fact that penguins stick to the bottom of the Earth. And I, for one, am grateful. I- I like penguins.

Interesting, huh? When we say that gravity pulls "down," what we really mean is that it pulls things towards the center of the Earth. But what if I want to take a break from the Earth? What if I'm an astronaut, and I want to take a vacation on the moon? How could I possibly escape the gravity of the Earth, and if I can, what would happen as I get closer to the moon? I guess there's only one way to find out.

=====Over (to) the Moon (6:50)=====

You know how many people have actually been on the moon? Twelve. That's all. But one day, we may go back there. We have a lot more to learn about the moon and space in general. So some day, maybe in your lifetime, we'll send astronauts out there to study and explore. Do *you* want to be one of them?

If you do, let me give you some helpful tips about a little thing called gravity, because you're going to need to know all about what gravity is and how it works if you're going to escape the pull of Earth and fly to the moon.

Now, you already know that astronauts can leave the Earth, but it takes a lot of effort to boldly go where few have gone before. But once astronauts reach the speed called escape velocity, they're able to overcome the force of Earth's gravity and get into orbit around our planet, or head on over to the moon. So, this brings up an interesting question: what happens when an object gets away from Earth's gravity, but close to the moon's gravity?

[text: Big Question]

You already know that gravity is the force that keeps us from flying off the surface of the Earth. And you know that gravity pulls things, not down, but towards the Earth's center. You also know that gravity exists between any objects that have mass, and the greater an object's mass is, the greater the effect of its gravity, or pull on other objects, is.

But there's something more. Remember Isaac Newton, the apple tree guy? He determined that the amount of gravitational force, or pull, between two objects also depends on how far apart they are. So the farther away something is from the Earth, the less it will feel the pull of Earth's gravity. And the closer it gets to the moon, the more it will feel the moon's gravity pulling on it.

Let's do a little pretending to see what happens to something when it moves closer to an object that has a really large mass, and therefore, a really strong pull of gravity.

[text: Investigation]

If you've ever made a wish on a shooting star, you've seen the effect of Earth's gravity pulling on an object. Shooting stars, which are actually meteors, occur when pieces of rock break off from a passing comet or asteroid and get too close to the Earth.

For example, say this globe represents the Earth, and the marble represents a piece of space rock that's flying by. You can see that there's a huge difference in size between the two objects. And, if we were to put them on a scale, we'd see that there's a big difference in their mass too. Our model Earth has a larger mass.

If the space rock is far away from the Earth, then it can go on its merry way, since it won't be affected by the Earth's gravity. *But* if it gets too close, then it and the Earth engage in a bit of tug-of-war, since both have gravity that pull on one another.

It's not much of a fight though. The more massive Earth has a much larger gravitational pull, so the rock gets caught in Earth's gravity, and most of the time, it gives us a brilliant streak of light we call a meteor.

But what does this mean for our space travelers? Well, when an astronaut ship takes off for the moon and moves away from the Earth, the farther away it goes, the less it feels the pull of Earth's gravity. And, as it gets closer to the moon, the spaceship begins to feel the tug of the *moon's* gravity more.

So even though the moon has a smaller mass than the Earth, and has less of a pull on the ship than the Earth does... once the ship gets closer to the moon than the Earth, the moon's gravity pulls the ship toward it. And then the astronauts can make a safe landing!

[Text: Conclusion]

So we can make the argument that two things affect the pull of gravity: First, the size of the object. Objects with a bigger mass have a stronger pull of gravity. And second, the distance between objects. The farther apart objects are, the weaker the pull of gravity between them, and the closer together they are, the stronger the pull of gravity.

All of this means that when the day comes that you're flying a spaceship to the moon, you just have to escape *Earth's* gravity, and then get close enough to the moon to enter its gravity. Remember that when you're grown up, and you're welcome.

If you wanna thank me, you could just name a crater or something after me when you get there.

So here's what we know so far: whether on Earth or in space, anything that has mass will exert the force of gravity. And on Earth, everything falls toward the middle of the Earth at the same rate. But hang on a sec: you've probably noticed that if you drop a piece of paper or a feather, it takes longer to reach the ground than something like a rock or a ball. So what's up with that? It's time to investigate!

=====Danger: Falling Objects! (10:50)=====

I don't care who you are. If you live anywhere near this planet, then you're no stranger to gravity, the force that affects every object on earth and beyond.   Because of gravity, whether you're an astronauts on the International Space Station or an ordinary, clumsy, earthbound human who happens to drop her books a lot, all things caught in our planet's gravity will, in some way, have the potential to fall to Earth.   But objects fall differently, right? Like, when I knock a piece of paper off my desk, it takes a lot longer to fall to the ground than if I knock a book of my desk. So what's up with that? Why do things seem to fall at different speed on Earth?

[text: Big Question]   Well, we already know that all objects have mass, they have a certain amount of matter in them and when gravity pulls on an object, it gives the object weight.   Now a long time ago, people used to think that heavier things fell faster than lighter things because that's what our senses told us. Now it certainly looks like the book falls faster than the piece of paper and why would we expect anything else? That would be like dropping a hammer and a feather and expecting them to hit the ground at the same time, except the thing I just said about the hammer and the feather, someone did actually try that and they did hit the ground at the same time. It just didn't happen on Earth.   True story: when astronaut Dave Scott was on the moon in 1971, he did an experiment where he dropped a falcon feather and a hammer from the same height and they hit the ground at the same time. Now how can that be? If you drop a hammer and a feather on earth, the feather would take a lot longer to reach the ground. So what does the earth have that the moon doesn't?   For one thing: an atmosphere. The gases that make up Earth's atmosphere push against objects as they fall and the push of the air against a falling object causes friction. We call that friction air resistance.   So on Earth, the feather's flat, fluffy shape makes it run into more air resistance than the hammer does. This makes it fall more slowly than the hammer but since the moon has almost no atmosphere, there is almost no air resistance so the two objects fell at the same rate. So it seem to me it's the resistance of air pushing against objects that really affects how fast objects fall. And that means it's experiment time.
[text: Investigation]

But you don't have to go to the moon to do this so don't pack your bags or anything. All you need are two pieces of paper that are the same size. Crumple one of the pieces into a tight ball and leave the other one smooth and flat. Now drop each piece of paper from the same height, let's say a meter, and then write down in a table how long it takes each piece to reach the ground.   You'll see it takes the flat paper longer than the crumpled paper to hit the floor. This is evidence that an object's shape affects how fast it seems to fall to Earth because the two pieces of paper are exactly the same. They have the same mass, but air resistance makes the flat paper seem to fall more slowly than the crumpled paper.

[text: Conclusion]   So, based on the result of our experiment, we can say, at least here on Earth, objects appear to fall at different rates, not because they have different masses or weights but because of air resistance. The force that the Earth's atmosphere has on objects as they fall.

So there you have it! Gravity is the force that's exerted by everything that has mass, and it's felt by everything equally, even though falling objects on Earth might not look like that's the case. I mean, if you don't believe me, you could go to the moon and do the old hammer and feather experiment for yourself. Or, you could just trust me.

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[outro plays]