Lesson: “How can we protect a mountain town from falling rocks?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! Have you ever been to the mountains? Some people visit the mountains, like to visit a national park or to go skiing. That's because many people find mountains beautiful to look at. Maybe some of you out there even live near the mountains. Lots of towns are near mountains. One thing you might notice if you ever visit the mountains are all the signs along the sides of the road that look like this. Or, in some places, the signs look like this. These signs are warning people to be careful of falling rocks. This can be a real problem for many mountain towns. Mountains are made of rock, and sometimes pieces of rock come loose. Maybe it rains, and so the mountain gets slippery. Well, those rocks start tumbling down the mountain. It might not seem like a big deal. Say that a rock tumbles just a little bit on the mountain. It's moving slowly. Now, what do you think will happen if that rock bumps into a tree?

EXPLORATION VIDEO 2

If a small rock tumbles slowly down a mountain and then it hits a tree, it'll push on the tree, but it'll stop right there. If a rock tumbles fast, it will have a stronger push, strong enough that—watch what happens. Whoa. Did you see that? It could break a tree and knock it over. Let's watch that again. Here's the rock tumbling fast—oh, and it knocked the tree over. It's just

like a bowling ball knocking over bowling pins. So, the faster a thing moves, the stronger it pushes on something when it bumps into it. That's why those falling rock signs are on the road. They're a warning to drivers: Be careful if you see falling rocks. If they're falling fast, they could push so hard that they damage your car. Now, what if a really, really big rock is falling and tumbling? Now, if that rock crashes into something, what will happen? How much damage do you think a rock can do if it's big, even if it's tumbling slowly? Well, here is a true story. In a small town in the country of Italy in Europe, there was a house and barn that was built near the bottom of a hill. One day, a large rock from the top of the hill came tumbling down. And guess what? Luckily, the rock missed the house and the farm animals. Phew, no one was hurt. But, as the rock tumbled, the barn was in its way. The barn used to be right here. You see that? The rock was not tumbling very fast, but it was a big rock. And so, even though it just tumbled slowly, it gave a huge push to the side of the barn. And that push was strong enough to knock down the walls of the barn. A rock that tumbled down a hill was strong enough to act like a bulldozer. Now, if another giant rock ever rolled down that mountain, it'd be great if there were a way to make sure that it would miss the house again. Think about that. What could you do to change the direction a giant rock was rolling so that it wouldn't hit the house?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to play a game called Boulder Bump. In this game, you will protect a town from a boulder that's rolling downhill. Now, you wouldn't want to roll a big boulder at a real town. Someone could get hurt. So, you're going to play this game with a pretend town, called Tiny Town—a town made of paper houses. A scientist would call Tiny Town a model. It's a small version of the real thing so that you can experiment. Tiny Town is at the bottom of a steep hill made out of cardboard. Now, just for fun, imagine that you're a very tiny person who lives in

Tiny Town in a beautiful paper house. One day, you take a hike up the cardboard hill and you see a large boulder that's about to come loose. Unless you do something, this boulder will roll down the cardboard hill and crush the town. So, you run over to the local construction company, Itty Bitty Builders, and you ask for their help. The Itty Bitty Builders say that they have a dump truck that they can use to take the boulder away, but they can't get it up to the top of the cardboard hill. They say that if you can safely get the boulder into their dump truck at the bottom of the hill, they'll take care of the rest. So you ask them if they have anything that could safely guide a boulder that's rolling down the hill so that it doesn't hit the town. They offer you the only things they have strong enough to do the job—five strong poles made of pushpins. If you put a pushpin pole in the boulder's path, you can change the direction that the boulder's rolling. You want the boulder to roll right into the dump truck so that the Itty Bitty Builders can take it away. You can do it if you put your pushpin poles in the right places. You're going to work with a partner to figure out where to put those pushpin poles. You and your partner will take turns testing out different ideas. And you only have five poles, so you'll have to choose carefully where you put them. I'll show you how to get started, step by step.

ACTIVITY STEP 1

Find a partner. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

You and your partner go to a game station. There should be everything you see here, including five pushpins and a ping pong ball.

ACTIVITY STEP 3

Make sure the houses are set up right at the bottom of the cardboard hill, like this.

ACTIVITY STEP 4

If there are any pushpins on the hill, take them out. Then roll the ball down the hill by lifting the cup. What happens to Tiny Town?

ACTIVITY STEP 5

It looks like you need a pushpin because Tiny Town got smashed. You and a partner are going to take turns deciding where to put the pushpins. You'll need to decide who will go first. And then, Player One, you'll put a pushpin on the hill. You can put it anywhere you want. Remember, the goal is to get the ball into the cup and to save the town. When you're done choosing who will go first and where to put the pushpin, go to the next step.

ACTIVITY STEP 6

Player One, roll the ball down the hill and watch what happens. Player Two, watch what happens and think about where you'll put the next pin.

ACTIVITY STEP 7

Player One, put the ball back in the cup and set up the houses. Then roll the ball down the hill again. Does the same thing happen? If the ball didn't do the same thing each time, try it a third

time to make sure you know what is really happening. Be sure to set up the houses after each try.

ACTIVITY STEP 8

Player Two, it's your turn. You can either move the pushpin, or you can add another pushpin. Then roll the ball down the hill. Watch what happens. Then roll it down again to see if it does the same thing. Wow. Our ball crushed the town both times.

ACTIVITY STEP 9

Keep taking turns. On each turn, you can either move or add a pushpin. Remember to test two times after each change with the pushpins. Go ahead and do this for at least five minutes and see if you can save the town. When you're all done, go to the next slide. Or, if you run out of time and haven't quite got the ball into the dump truck, that'll be okay too. Still go to the next slide after five minutes. That's five minutes. Go to the next slide.

ACTIVITY STEP 10

Discuss, then go to the next slide to watch the final video.

WRAP-UP VIDEO

Were you able to safely get the boulder into the dump truck? We tried moving the pushpins to a lot of different places to find a way that worked. Here's one way: Watch this. But this is just one way to set up the pushpins—there are a lot of other ways to protect the town, like this even. Wherever your pushpins ended up, in all of them the ball bounces off a pushpin, getting a push

to send it in a different direction. In real life, rocks really can tumble down mountains and break things. Scientists look for large rocks that might come loose on mountains, and they try to figure out ways to make the people who live below safer, just like in the activity we did. If we think about pushes, and how we can change which way a push goes, we can make something go a different way, a different direction. And it's not just true for ping pong balls and falling rocks—this is true for anything that might push into something and cause a problem. Like this truck accidentally went backward and bumped into this pole, but the pole pushed the truck forward. If the truck had kept backing up, it could have crashed into a building behind it, so the push that the pole gave helped the building and the truck stay safe. There are poles that push things out of the way of danger in other places too, like in this warehouse. A warehouse is where people store lots of things on big shelves and forklifts, that carry boxes, drive around. That's kind of dangerous, so people put poles in warehouses—the poles can push the forklifts out of the way if they get too close to the shelves, changing the direction of the forklift so that everything stays safe. So, next time you see a pole, think about how it could help something change direction with a push. Have fun, and stay curious.