Lesson: “How much water should you give a plant?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi. It's Jay from the Mystery Science Team. When I was a kid, I went on a field trip to this place. It's called the Mitchell Park Domes. The building is made up of three huge glass domes. This one here, this one, and this one. Inside each dome is a whole world of wild and beautiful plants. Spiky cacti like these, delicate flowers like these, curly green ferns, and more. Walking around, you feel like everything around you is just bursting with life. Plants thriving and blossoming wherever you go. These days, my wife Diana has created a tiny version of the Mitchell Park Domes inside our home. Okay. Maybe that's going a bit far. We don't exactly have three beautiful, round, glass rooms to fill up with plants. But Diana does collect plants she thinks are cool or beautiful or interesting and grows them in pots inside. Under her care, her plants have grown big and healthy. So, when Diana went out of town on a business trip, I was determined to keep her plants growing healthy. I knew that all plants need sunlight and water to live, so I put the pots on a sunny windowsill, and I watered them once a day. But even though I was so careful, before too long, some of Diana's plants didn't look as healthy as they did before.
By the time Diana came home, one plant had even turned brown in places and flopped over. What did I do wrong? I gave this plant lots of sun, lots of water. That's everything a plant needs, right? I wonder what you think. Why do you think this plant wilted? Can you think of anything I could have done differently to keep the plant healthy?

EXPLORATION VIDEO 2

Diana has been growing house plants for years, and they rarely wither and wilt. So, what's her secret? Does she have a magical green thumb? I asked Diana, and she said, no. She's just had lots of time to learn about plants, try out different things, and figure out how best to take care of what she's growing. I wanted to learn to take better care of her plants too. So I asked Diana what she thought had made the plants wilt. She said I probably gave them too much water or too much sunlight. Now you might be thinking, "wait, too much sunlight and water? Don't plants need sunlight and water?" That's true. But think about the things you need to survive.

You need water, right? But what if at lunch, someone brought you a bathtub filled with drinking water and said, "You need water, right? Wanna drink this whole thing?" You'd be like, "No way." That's way, way more water than you need. If you tried to drink all that water at once, you'd get really sick. Just like you, a plant can have too much of a good thing. A plant might wilt if it gets less sunlight and water than it needs. But a plant might also wilt if it gets more sunlight than it needs or more water than it needs. So how do we figure out how much is too much and how much is not enough for each plant? Let's go back to the Mitchell Park Domes and take a closer look. Maybe that will give us clues about how plant experts care for their indoor plants. Let's take a tour inside this dome. We'll call this Dome 1. As we walk inside, pay attention to what you see. I'll be quiet for a minute so you can observe. Okay. Now let's step inside a different dome. We'll call this Dome 2. As we explore Dome 2, see if you can notice what's the same and what's different from the last dome we saw. Again, I'll be quiet for a minute so you can observe. Okay, great. Now that you've visited two different domes, I'm curious, what's different about these two places?

EXPLORATION VIDEO 3

When you walk inside Dome 1, you see lots of prickly green cacti soaking up lots of sun. There are squat palm trees and lots of plants in different flat and spiky shapes poking out of the rocks and sandy soil on the ground. Dome 1 is called the Desert Dome. Most of the plants that live in this dome originally came from desert habitats across the world, like this. Deserts don't get much rain, but they do get lots of sunlight. So the plants that naturally grow in deserts grow best with just a little water and lots of sunlight. To make this dome as much like a desert as possible, the plants inside are barely watered. Most of these plants are placed where they'll get lots of sunlight throughout the day. Those conditions help these plants thrive. But in Dome 2, you won't find any cacti. Instead, when you walk in, you're plunged into a shady, lush, leafy green forest. There are tall, leafy trees; plants with big, broad green leaves covering the ground and stretching up towards the treetops; and curly green ferns peeking out around the edges of a pond. This dome is called the Tropical Dome. Most of the plants in this dome come from rainforests, like this. Rainforests get lots of rain. They also have lots of trees. Those trees cast shadows on the ground, so there's a lot of shade. Plants that thrive in a rainforest need lots of water and not that much sunlight. So in this dome, plants are watered twice a day and planted where they get some sunlight, but mostly a lot of shade. Those conditions help these plants thrive. Think of it this way: Remember that bathtub full of drinking water from earlier? That's way more water than you need in a day, but it might not be too much water for these guys. Elephants have been known to drink more than a bathtub-sized amount of water per day. For an elephant, not only is this not too much water, it might be too little. On the other hand, while this camel can drink lots of water when she's thirsty, she only needs to drink water about once a week. So if she already drank water earlier that week, even a regular-sized bottle of water might be more

water than she needs to survive. An elephant, a camel, and a human are all different. They all need water to live, but they need different amounts of water to survive and stay healthy. It's the same with plants. These plants are different. They need different things in different amounts to thrive. That's fine if you already know where your plant comes from and what it needs. But what if you don't? Like, let's say you want to add these plants to the Mitchell Park Domes. You want them to grow and stay healthy, but you don't know anything about where they came from or how much water and sunlight they need. How could you figure out whether to add them to the Desert Dome or the Tropical Dome?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to figure out which location—the Desert Dome or the Tropical Dome—is the best place for some new Mystery Plants to grow and stay healthy. These Mystery Plants just arrived at the domes, but there's a problem: We don't know which habitat these Mystery Plants originally came from. Did they come from a desert, like this, or did they come from a tropical rainforest, like this? Do the Mystery Plants need a lot of sunlight, or do they grow best with lots of shade? Do they need lots of water, or do they stay healthier with just a little bit of water? To figure this out, you'll set up two experiments: a Water Experiment and a Sunlight Experiment. To help you think through your experiments, you'll talk to these students—Ahmed, Bianca, and Carlos—who each have different ideas of what to do. You'll have to pay close attention to what you change in each experiment but also pay attention to the things you keep the same. Your goal is to create the best experiments to figure out the needs of these Mystery Plants. The results from your experiments will help you figure out if these Mystery Plants should be permanently placed in the Desert Dome or in the Tropical Dome. We'll show you how to get started, step by step.

ACTIVITY STEP 1

In today's activity, you'll set up your own experiments, but you'll work with a partner to share your ideas. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies.

ACTIVITY STEP 3

You'll need to get your experiment pieces ready. So get your Build-Your-Own Experiment sheet, and first, cut along the thick, gray line. Save this long piece to use as scrap paper later. Then, cut along all the dotted lines. Separate the pieces into three piles so they're easier to find later.

ACTIVITY STEP 4

Let's do the Water Experiment first. Get your Water Experiment worksheet and then find two Mystery Plant pieces. Turn these pieces over. To keep glue off your table, use this piece of scrap paper. Put the Mystery Plant piece on the scrap paper and add some glue. Then place one Mystery Plant in Box A and the other in Box B. It should look like this when you're done.

ACTIVITY STEP 5a

In the Water Experiment, we want to figure out if our Mystery Plants need lots of water or just a little water. Ahmed, Bianca, and Carlos all have different ideas for how to set up the Water Experiment. Ahmed says, “I think we should keep one plant in the sunlight and one plant in the

shade." Bianca says, "I think we should give one plant lots of water and one plant just a little water." Carlos says, "I think we should give one plant lots of water and sunlight and one plant just a little water and put it in the shade." We want to figure out how much water the Mystery Plants need to stay healthy. So which idea do you think would help us figure it out? Why do you think that?

ACTIVITY STEP 5b

Here's what we noticed. Ahmed's idea is to change the amount of sunlight that each plant gets, but that experiment won't help us figure out how much water these plants need. So we don't think Ahmed has the best idea right now. Bianca's idea is to change the amount of water that each plant gets. That experiment should help us figure out how much water these plants need. So this idea seems pretty good. But what about Carlos? Carlos has the idea to change both the amount of sunlight and the amount of water at the same time. This isn't a bad idea, but we think that the results will be confusing if we change two different things at the same time. So we decided that Bianca's idea is probably the best. When you're ready to set up the Water Experiment, click the arrow on the right.

ACTIVITY STEP 6

Now that we have an idea of how to set up our Water Experiment, let's add more pieces to the worksheet. With Bianca's experiment idea, the amount of sunlight is the same for each plant. So find two Sun pieces and add glue to the back of each one. Place one Sun piece in Box A and one Sun piece in Box B. Then use your crayons to color each Sun.

ACTIVITY STEP 7

With Bianca's experiment idea, the amount of water is different for each plant. Find two Water Container pieces. Add glue to the back of each piece and then add them to your Water Experiment worksheet. Bianca's idea is to give one plant lots of water and the other plant just a little water. So use your crayon to color in each Water Container so that the plant in Box A will get lots of water and the plant in Box B will get just a little water, like this.

ACTIVITY STEP 8

Bianca ran the Water Experiment for three weeks. She made sure the plants both got the same amount of sunlight. She made sure they got different amounts of water. She gave the plant in Box A lots of water. After three weeks, it looked like this. She gave the plant in Box B just a little water. After three weeks, it looked like this. Discuss: Which of the Mystery Plants looks healthier? Why?

ACTIVITY STEP 9

Here's what we noticed. The plant that got a lot of water started to turn a bit yellow and only grew two new leaves. The plant that got just a little bit of water stayed bright green and grew four new leaves. Because the Mystery Plant that got just a little bit of water stayed bright green and grew more, we think that this plant is healthier. Draw the new leaves on your plants with your pencil and then use your crayons to show what the Mystery Plants looked like after the Water Experiment.

ACTIVITY STEP 10

Discuss this question with your partner: Based on these results, how much water do the Mystery Plants need to stay healthy? Then circle your answer on your worksheet where it says Results.

ACTIVITY STEP 11

Congratulations! The results from the Water Experiment show that our Mystery Plants stay healthy when they have just a little bit of water and that they don't stay healthy if they are given lots of water. Now let's do the Sunlight Experiment. Get your Sunlight Experiment worksheet and then find two more Mystery Plant pieces. Turn these pieces over and add some glue. Place one Mystery Plant in Box A and the other in Box B. It should look like this when you're done.

ACTIVITY STEP 12a

This time instead of studying the amount of water, we want to figure out if our Mystery Plants grow best with lots of sunlight or if they grow best in the shade with just a little sunlight. Ahmed, Bianca, and Carlos still have different ideas for how to set up an experiment. Ahmed says, “I think we should keep one plant in the sunlight and one plant in the shade.” Bianca says, “I think we should give one plant lots of water and one plant just a little water.” Carlos says, “I think we should give one plant lots of water and sunlight and one plant just a little water and put it in the shade.” Which experiment do you think would work best to figure out how much sunlight the Mystery Plants need to stay healthy? Why do you think that?

ACTIVITY STEP 12b

Here's what we noticed. This time we want to figure out the amount of sunlight to give our Mystery Plants. So we don't think Bianca has the best idea this time because her idea is to change the amount of water, not the sunlight. So we decided to focus on Ahmed's and Carlos's ideas. Carlos still has the idea to change both the amount of sunlight and the amount of water at the same time. But just like before, if we change two different things at once, we think the results might be confusing. Ahmed’s idea is to only change the amount of sunlight that each plant gets. So we decided that Ahmed’s idea is probably the best. When you're ready to set up the Sunlight Experiment, click the arrow on the right.

ACTIVITY STEP 13

Now that we have an idea of how to set up our Sunlight Experiment, let's add more pieces to the worksheet. With Ahmed’s experiment idea, the amount of water is the same for each plant. So find two Water Container pieces and add glue to the back of each one. Place one in Box A and the other in Box B. We learned in our Water Experiment that the Mystery Plants stay healthy with just a little water, so go ahead and color in the Water Containers to show that you'll give them just a little water. Remember, we want to keep the amount of water we give each plant the same this time.

ACTIVITY STEP 14

With Ahmed’s experiment idea, the amount of sunlight is different for each plant. Find two Sun pieces. Add glue to the back of each piece, and then add them to your Sunlight Experiment worksheet. Then use your crayon to color in each Sun. Ahmed's idea is to give one plant lots of

sunlight and the other plant just a little sunlight with lots of shade. Ahmed decided that an umbrella could provide lots of shade. So go ahead and draw an umbrella in Box B, like this. Then you can color it with your crayon and use your pencil to add some shade underneath the umbrella, like this. Now the plant in Box A will get lots of sun and the plant in Box B will get just a little sunlight. Click the arrow on the right when you're ready to move on.

ACTIVITY STEP 15

Ahmed ran the Sunlight experiment for three weeks. He made sure the plants got the same amount of water. He made sure they got different amounts of Sun. He kept the plant in Box A in the sunlight. After three weeks, it looked like this. He kept the plant in Box B in a shady spot underneath an umbrella. After three weeks, it looked like this. Discuss: Which of the Mystery Plants looks healthier? Why?

ACTIVITY STEP 16

Here's what we noticed. The plant in the sunlight stayed bright green and grew six new leaves. The plant in the shade turned a little yellow and didn't grow any new leaves. Because the Mystery Plant that got more sunlight stayed bright green and grew more, We think that this plant is healthier. Use your pencil to draw the new leaves, then use your crayons to color in the Mystery Plants to show what they looked like after the Sunlight Experiment.

ACTIVITY STEP 17

Discuss this question with your partner: Based on these results, how much sunlight do the Mystery Plants need to stay healthy? Then circle your answer on your work where it says Results.

ACTIVITY STEP 18

Congratulations! The results from our experiment show that our Mystery Plants stay healthy when they have lots of sunlight and that they don't stay healthy if they are in the shade. Look at the results of your Water Experiment and the results of your Sunlight Experiment. Discuss these questions with your partner: Do you think the Mystery Plants would stay healthier in a desert habitat or in a tropical rainforest habitat? Why do you think that?

WRAP-UP VIDEO 1

In the activity, you helped Ahmed, Bianca, and Carlos figure out which dome the Mystery Plants will grow best in: the sunny, dry Desert Dome, or the shady, wet Tropical Dome. To do this, you had to figure out how best to answer two different questions: how much water the plants need, and how much sunlight the plants need. From Bianca's Water Experiment, we discovered that the Mystery Plants stay healthier when they get only a little water. From Ahmed's Sunlight Experiment, we discovered that the Mystery Plants stay healthier when they grow in lots of sunlight. Based on those results, we decided that they would do best in the dry, sunny Desert Dome. Ahmed and Bianca both suggested experiments that changed one thing. In Bianca's experiment, everything was the same for both plants except the amount of water. Both plants got the same amount of sunlight, the same type of soil, the same amount of time to grow. Everything the same. Just the amount of water was different. That way, if one plant stayed healthy and the other didn't, Bianca could be pretty sure it was because of the amount of water. Meanwhile, in Ahmed's experiment, everything was the same for both plants except the amount of sunlight. In his experiment, if one plant stayed healthy and the other didn't, Ahmed could be pretty sure it was because of the amount of sunlight. Carlos tried to answer both questions with

one experiment by giving one plant a lot of sunlight and water and the other plant a little sunlight and water. At first, that might seem like a great plan. You can answer both questions at once. But consider this: if one stayed healthy and the other didn't, how would you know if it was because of the sunlight or the water? The more things you change in an experiment, the more complicated it is to figure out what your results mean. Today, you only did these experiments on paper. But imagine you wanted to do the experiments you designed in real life. Can you think of any new challenges you might face if you tried these experiments with real plants in a real habitat with real sunlight and real water?

WRAP-UP VIDEO 2

Designing an experiment can be tricky, especially if the question you want to answer has multiple parts like ours did here. And they can get even trickier when you do experiments out in the real world. Like, imagine if I did experiments with Diana's plants to see how much water they need. What if one plant was in a warmer spot and the other was in a cooler spot? What if one plant was less healthy than the other before I even started the experiment? Or what if our dog got into one of the plants but not the other? At the end of the experiment, one plant might be healthier than the other, but I wouldn't know if it was because of the amount of water or because my dog ate half of the experiment. Out in the real world, it's nearly impossible to find two situations where everything is the same except one thing. There are just so many things that can be different about a real-world situation that it can be difficult to control all of the factors that could change your results. There are thousands and thousands of different kinds of plants living in thousands and thousands of different kinds of habitats all over the world. Some plants grow in extremely sunny habitats like deserts or extremely rainy habitats like tropical rainforests. Others thrive in more varied places, places that are rainy sometimes and dry other times, or shady

sometimes and sunny others, places where water is frozen into snow or ice, or places that are flooded with water all the time. Each different kind of plant in each different kind of place has its own unique needs. And as challenging as experiments can be to figure out, experiments are one of the best ways we have to learn about these incredible living things and how to help care for them at home and in the wild. Keep experimenting, and stay curious.