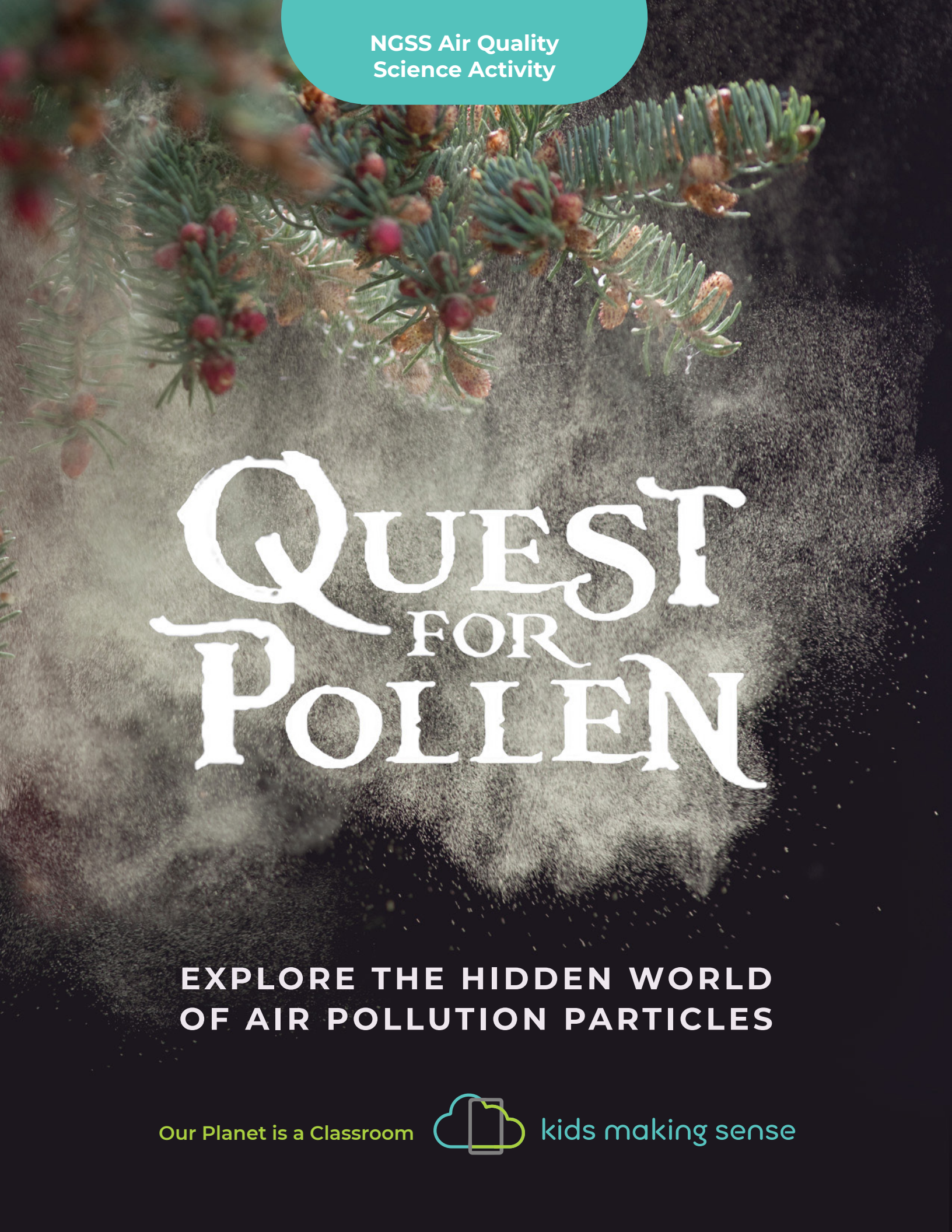
NGSS Air Quality
Science Activity



Quest for Pollen

EXPLORE THE HIDDEN WORLD OF AIR POLLUTION PARTICLES

Our Planet is a Classroom

kids making sense

Quest for Pollen

Have you ever walked outside in the spring or fall to find a yellow layer of powder covering cars or the ground?

Have you ever seen clouds of powder coming from trees in the wind? Have you suffered from hay fever or seasonal allergies (sneezing, runny nose, itchy eyes)?

Pollen is the culprit behind each of these phenomena.

But what exactly is pollen?

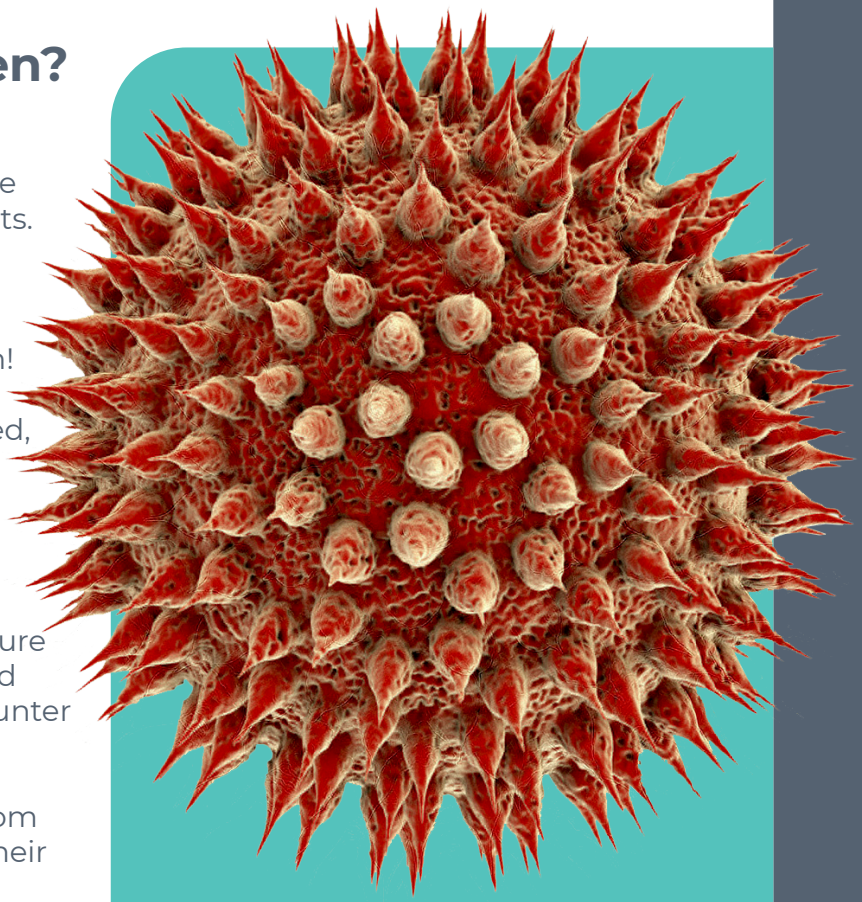
Pollen is a very fine powder that trees, plants, grass, and other vegetation release into the air as a way to fertilize other plants.

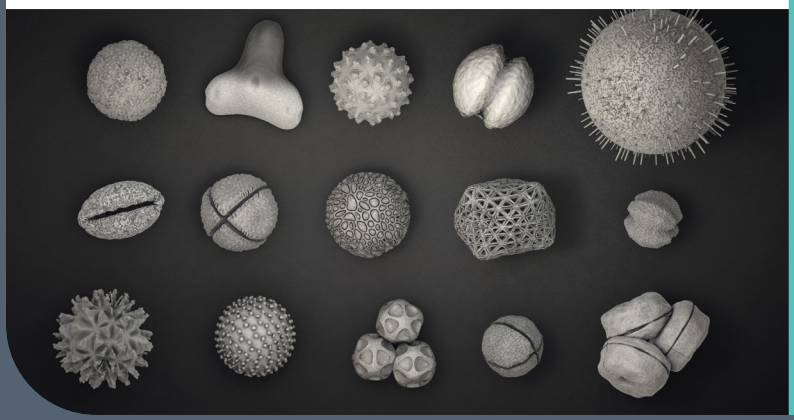
If you have looked closely at blossoms on trees, the center of flowers, or the fuzzy cones on pine trees, you have seen pollen!

The pollen in these cases are concentrated, which makes it look like a powder or clump and allows us to easily see it.

A closer look at pollen reveals it is made up of individual grains, or particles. Each of these particles has a fascinating structure that is designed to help pollen spread and survive the harsh conditions it may encounter in the air once it leaves the plant or tree.

Below are magnified images of pollen from a variety of different plants. Notice how their structures vary.





Once pollen grains are in the air, they are considered particulate matter and thus behave as other particulate matter does. More specifically, they can travel through the air and be breathed in.

What Is Particulate Matter?

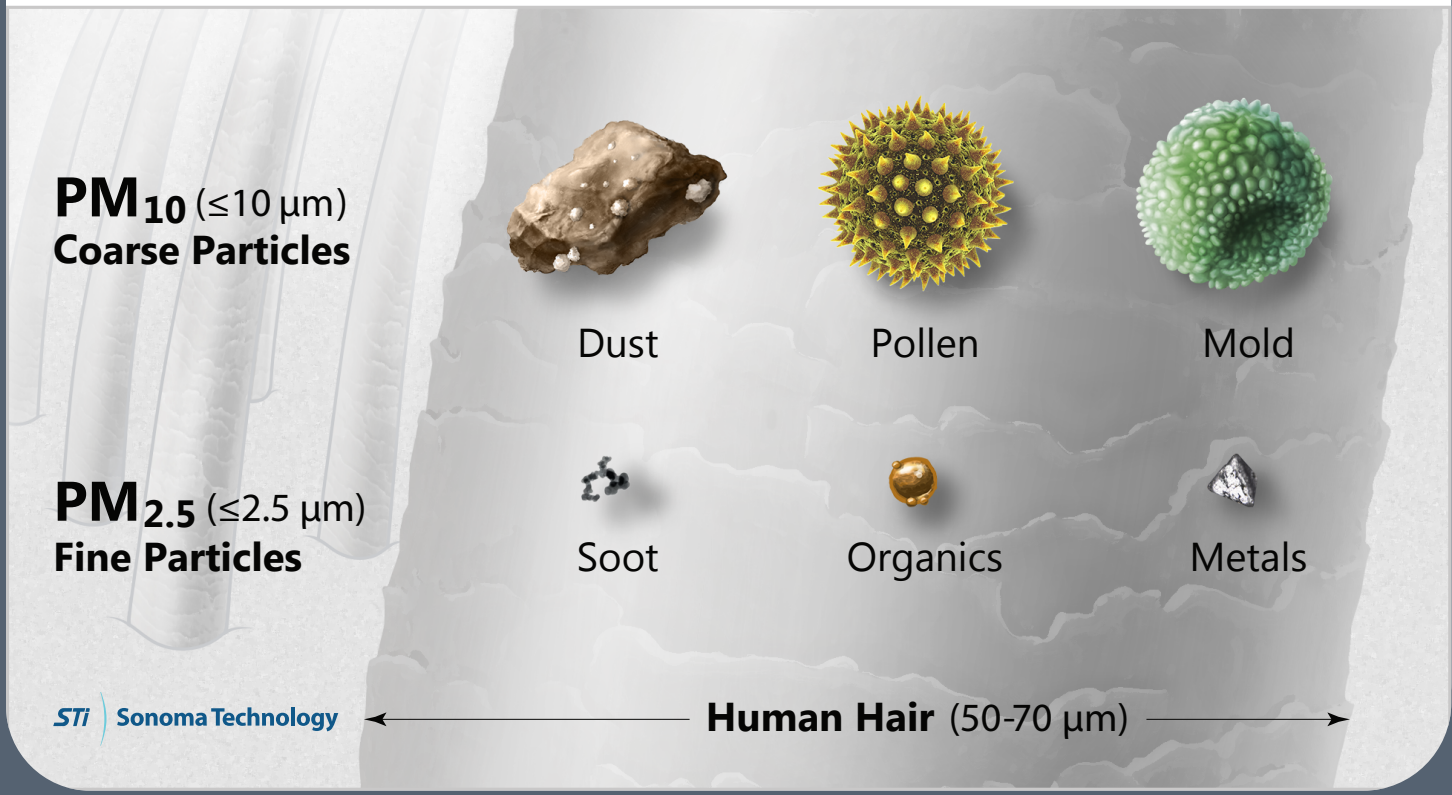
Pollen is just one type of particle, also called particulate matter (PM), which is tiny solid or liquid particles in the air. If you are exposed to PM and breathe it in, the particles may deposit in your lungs, causing them to become inflamed and irritated. People with asthma may also suffer increased breathing problems when around high levels of PM.

Pollen presents an additional issue as many people suffer from hay fever or seasonal allergies, which can cause runny noses, sneezing, eye irritation, or other ailments.

How Small Are Airborne Particles?

To understand how tiny these particles are, we have to think in terms of microns, or micrometers (μm). You may not be used to thinking of things that small, so check out the diagram below.

A human hair is approximately 50-70 μm in diameter. You can see that PM10 (particles that are 10 μm in diameter or smaller) could fit many times into the diameter of a human hair.



Since it is a natural and necessary process, we don't want to stop pollen release into the air from plants and trees. Instead, we can focus our attention on reducing our exposure to airborne pollen.

Let's begin our quest to find and view pollen

For this you will need to gather the following supplies:

Materials Needed

- Index cards or sturdy paper
- Scissors or a hole punch
- Clear tape
- A cell phone with a camera, a magnifying glass, or a microscope
- A pen or pencil
- String (optional)

QUEST FOR POLLEN

Planning Your Quest

You will be making your own pollen catchers which you will place in various locations to try to catch pollen outdoors. Before you make the catchers, let's first plan where you will put them.

Think of interesting places in your yard, at school, or in your community where you could place your pollen catchers.

You could consider putting them near different plants or trees that might produce different types of pollen. Are there trees or planters in your yard or on your street? Do you live near a park with trees and plants? Are there trees at school or your community center? These are all great places to set up a pollen catcher!

If you only have access to one type of tree or plant, try placing cards different distances away from the tree or plant to investigate how the amount (or concentration) of pollen particles changes as you get further from the pollen source.

List three locations that you can easily place three pollen catchers:

Example:

1. *Near the flower planter in the back yard*

2. *Under the tree on the corner of our street*

3. *By the pine trees in the front yard*

You will need to place at least two pollen catchers for this lesson, but more is better as it gives you more chances to catch pollen.

1. _____

2. _____

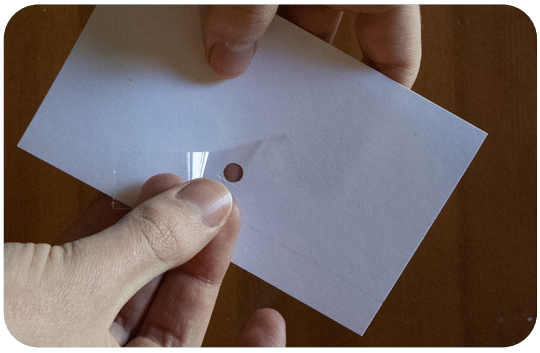
3. _____

Create Your Pollen Catchers

You will need 1 notecard for each location you planned above plus 1 additional note card that you will use to collect a reference sample.

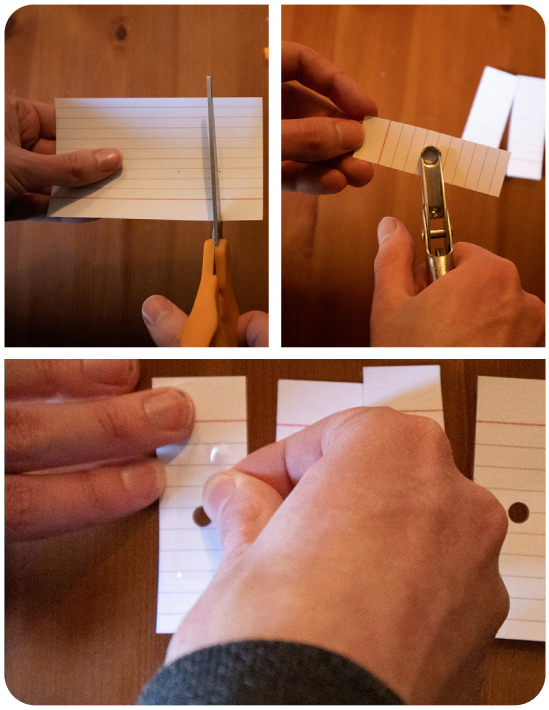
1. Take one of your notecards and carefully cut or hole punch a hole into the middle no bigger than the width of the tape, so that the tape can fully cover the hole. Try to make the hole the same size on each card.

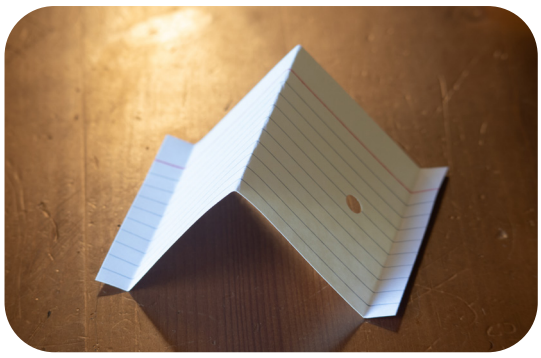
2. Tape over the hole so the sticky side of the tape faces upwards. Be careful not to touch the sticky side of the tape with your fingers or you might get a fingerprint on the tape!



3. Repeat this for each of your notecards or paper slides.

Optional: If you are using a microscope, you can first cut the index cards into 25mm wide strips to create paper slides that will fit on the stage of your microscope.





Depending on where you will be placing your notecards, you might want to fold some of them in half to help them stand up.

QUEST FOR POLLEN

Set Up Your Pollen Catchers

1. Take your newly made pollen catchers and place them outside in the locations you planned. Remember to place the pollen catcher so the sticky side of the tape faces up!

2. When you place each notecard outside, write the location on the card so you can keep track.

   You may also want to secure the pollen catcher to stop it blowing over in the wind. To do this you might place a rock on the corner of the notecard or tape the notecard to a surface

3. The amount of time you need to leave your pollen catcher outside will depend on factors such as how windy it is and how much pollen is present on the trees/plants. You might want to leave the catcher outside for 30 minutes and check on it and then leave it for another 30 minutes if needed, etc.

4. Once you have finished collecting, retrieve your pollen catcher. You can seal your sample using another piece of tape (so the pollen sample is sandwiched between two pieces of tape) or put the pollen catcher into a small ziploc bag. This will prevent debris from sticking to the pollen catcher.

Optional: Tape a piece of string to hang the pollen catcher from a tree branch, plant, or other structure. Make sure it's far away from other objects that it could blow into and collect debris.

Create a Reference Sample

So that you know what pollen looks like once you have captured it, you will want to create a reference sample.

1. Take the pollen catcher that you set aside for the reference sample earlier. Outside, find a tree or flower and investigate it to see if it has pollen.

2. Once you have found one, carefully tap or lightly shake the flower so that some pollen sprinkles onto the pollen catcher.

3. You can seal your sample using another piece of tape (so the pollen sample is sandwiched between two pieces of tape) or put the pollen catcher into a small ziploc bag. This will prevent debris from sticking to the pollen catcher.

   Keep in mind, the pollen you collect directly from the flower will be a much larger amount than the pollen you collect from the air.

QUEST FOR POLLEN

Investigate Your Samples

Now you will want to look closely at your collected samples. To do this you could use one of the following:

Magnifying Glass

Student Microscope

Cell Phone Camera

Zoom in to get a closer look at the particles and take photos.

Your Eyes

You could also do this by simply looking at the samples.

Depending on the method you are using, it might be helpful to place a blank index card or white or black piece of paper behind the pollen catcher to help you see the particles you have collected.

Make your cell phone into a microscope

Use your cell phone camera, a hair pin, and a lens from a laser pointer to create a home microscope.

With help from an adult, unscrew the lens from the laser pointer, wedge it into the open end of a hair pin, and tape it over the phone camera lens.

https://www.exploratorium.edu/snacks/cell-phone-miniscope

1. Start with the **reference sample** you collected. Look closely at the pollen. What do you notice about it? How would you describe it? Is the pollen a certain shape or color?

2. **For each of your other pollen catchers:**

   Remember, the pollen on these catchers might not be as obvious or concentrated as the pollen on your reference sample.

   Write down the location of each pollen catcher in the table below. Count the number of pollen particles you can identify. Remember, they may look yellow, orange, or another color based on the tree or plant they were near. Also write down the amount of time the pollen catcher was outside. In the observation column, write down anything you notice about the pollen. For example, its color, the amount of pollen you see vs. other types of particles, the shape of the pollen particles, etc.

Pollen Catcher Location	Number of Particles	Time (Minutes)	Observation

QUEST FOR POLLEN

Calculations

Since you now have the ***number*** of particles collected on each pollen catcher and the time that each pollen catcher was left outside, you can calculate the ***collection rate*** of each of your pollen catchers. In other words, the number of pollen particles landing on your pollen catcher per minute. For each pollen catcher, fill in the blanks below with the location of each catcher, the number of particles and the time, and then calculate the collection rate. You do not need to do this for the reference sample.

1. Pollen Catcher _____

Collection rate = _____ particles / _____ minutes = _____ particles per minute

2. Pollen Catcher _____

Collection rate = _____ particles / _____ minutes = _____ particles per minute

3. Pollen Catcher _____

Collection rate = _____ particles / _____ minutes = _____ particles per minute

4. Pollen Catcher _____

Collection rate = _____ particles / _____ minutes = _____ particles per minute

5. Pollen Catcher _____

Collection rate = _____ particles / _____ minutes = _____ particles per minute

6. Compare your answers. Were there certain locations where you collected more pollen? Why might that be the case?

7. If you were to repeat your experiment to collect more pollen, what would you change and why?

Ways to reduce your exposure to pollen

Oftentimes during the spring when pollen levels are high, people may want to avoid breathing in pollen to prevent allergies. Some strategies to avoid pollen include:

1. Check your local pollen forecast (this is sometimes available on weather forecasts and on the internet) and stay indoors on days when pollen levels are highest.
2. Run an air filter at home.
3. If you have to be outdoors, consider wearing an N95 or pollen mask to prevent you from breathing in pollen.

But there are many more ways to reduce your exposure to pollen.
What other ways can you think of?

NGSS: Next Generation Science Standards		Grade
5-LS2-1	Ecosystems: Interactions, Energy, and Dynamics	3-5 5
3-LS4-4	Biological Evolution: Unity and Diversity	6-8
4-LS1-1	From Molecules to Organisms: Structures and Processes	3-5 3
MS-LS2-3	Ecosystems: Interactions, Energy, and Dynamics	3-5 4
MS-LS2-4	Ecosystems: Interactions, Energy, and Dynamics	6-8
HS-LS2-4	Ecosystems: Interactions, Energy, and Dynamics	9-12
HS-LS2-2	Ecosystems: Interactions, Energy, and Dynamics	9-12