Unit 4:
The Power of Pollinators

Contents: Unit 4

Unit 4: The Power of Pollinators

Big Ideas	**Guiding Questions**
Organisms in an ecosystem are interdependent. Living things grow and change over time. The parts of an organism have specific functions. Pollination is a result of animal behavior. Animals, including humans, benefit from and depend on pollination.	What makes particular organisms interdependent? Why is it important to understand how living things grow and change over time? Why are the particular parts of an organism important? What can we understand about how organisms benefit each other? How does pollination happen? Why is pollination important to people and other animals?

	WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**
Weekly Question	What is important about seeds?	What do plants need to reproduce?	What do bees need to survive?	How does pollination happen?
Texts	*Cuckoo* Video: "The Beauty of Pollination" *From Seed to Plant*	*What is Pollination?* Video: "Pollination: trading food for fertilization" "Apples & Bees"	Music: "Flight of the Bumblebee" *Flight of the Honey Bee* *Amazing Bees*	*Animal Pollinators* "Insect pollinators" "Bees Are Not the Only Pollinators That Buzz" *The Little Hummingbird*
Writing	Report	Report	Report	Report
Science	Gathering questions, Observing seeds, Setting up germination experiments	Observing and discussing seed germination, Looking inside seeds	Learning about Roots, Measuring Growing Plants Quadrat Study 7	Ongoing observations and observational recording Take a field trip to a natural area
Studios	Children interact with ideas about seeds and plants.	Children interact with ideas about seeds and plants.	Children tell stories about pollination, construct beehives, and add to text.	Children choose familiar media to explore diverse pollinators and learn a new procedure in the Art Studio.
Foundational Literacy	Follow guide	Follow guide	Follow guide	Follow guide

Unit 4: The Power of Pollinators

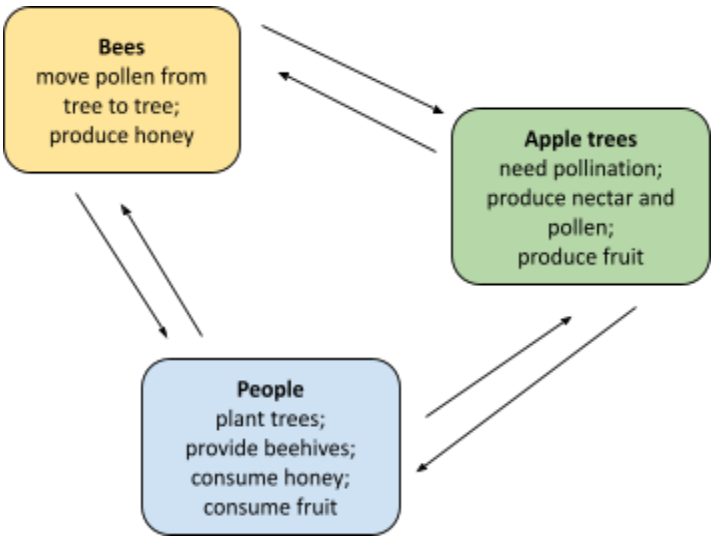
	WEEK 5	WEEK 6	WEEK 7	WEEK 8
Weekly Question	What makes a plant and a pollinator a good match?	Why is pollination important to people and other animals?		How do I and how do we contribute to our communities?
Texts	*The Little Hummingbird* "Bats Are Pollinators" Video: "Wings of Life - Bats" "The Vain Bat" Comparing folktales	Video: "Disappearance of the Bees: What's the Impact?" Introducing the Pollinator Project *What If There Were No Bees?*	Local Pollinators Brochure *Bee* *Are We Still Friends?*	"Classroom Hives" *Seeds of Change* Connecting our Texts Synthesis
Writing	Argument	Argument	Argument	Argument
Science	Ongoing observations Look for Evidence of Insects (FOSS Outdoors)	Designing hand pollinators Quadrat study 8	Designing hand pollinators	Designing hand pollinators
Studios	Studios work continues from Week 4: Children choose familiar media to explore diverse pollinators.	Pollinator Project work		Presentation, Celebration, and Reflection
Foundational Literacy	Follow guide	Follow guide	Follow guide	Follow guide

Unit 4: The Power of Pollinators

Birds, bees, butterflies, and bats! Flowers and fruit! Studying the process of pollination helps us understand how plants and animals are interdependent—designed to function in relation to each other—and how critical they are to human and global survival. In this fourth and final unit of study, children move between the plant and animal worlds, zooming in to closely observe and zooming out to explore big ideas around structure and function, growth, and interdependence. Children engage in thinking about our food supply and the immediate natural environment. Concretely, the unit begins with planting seeds, and children watch the plants' development over several weeks, pairing careful scientific process with the wonder and excitement of growing things.

Like Unit 2, *Unit 4: The Power of Pollinators* brings science to the foreground. Thus, text selection leans toward the informational; experiences in Science and Engineering are crucial for building conceptual understanding.

A critical scientific understanding embedded in this unit is that animals and plants do not set out to help each other. Instead, plants require the transfer of pollen in order to produce seeds, animals require the food plants produce, and humans benefit from the production of fruit. Pollination can be considered a happy and needed byproduct of animals doing what they need to do in order to survive, producing a series of mutually beneficial (but not *intentional*) relationships:



Texts have been chosen and discussions designed to simultaneously underscore this interdependence and challenge the anthropomorphizing of "helping" plants and animals. Text Talks also include some folktales and poems in balance with the informational texts. In this way, as in previous units, children will interact with the content in different formats and from differing perspectives. Many resources on the topic of pollination describe "plant sex"—the transfer of pollen from the male to the female parts of a plant—and this can be a helpful way for adults to understand the process. For second graders, pollination is framed as a series of connected and necessary interactions.

Note that in order to support this learning, some weeks have three days of Science and Engineering lessons and two days of Studios. As always, experiences in the Discovery Studio afford further opportunities to explore ideas introduced in Science and Engineering lessons.

Writing genres practiced earlier in the year are revisited and extended in Unit 4. Reports allow children to build and share expertise about specific, locally grown plants; arguments persuade an audience about the importance of planting to attract pollinators.

The Pollinator Project

Reading *What If There Were No Bees?* children learn about the impact of a decreasing population of honey bees, a master pollinator. Children address this real-world problem in two ways: by sharing their designs and prototypes of mechanisms for pollinating plants by hand when natural pollinators are dwindling or absent, and by writing about the importance of planting pollinator-friendly plants.

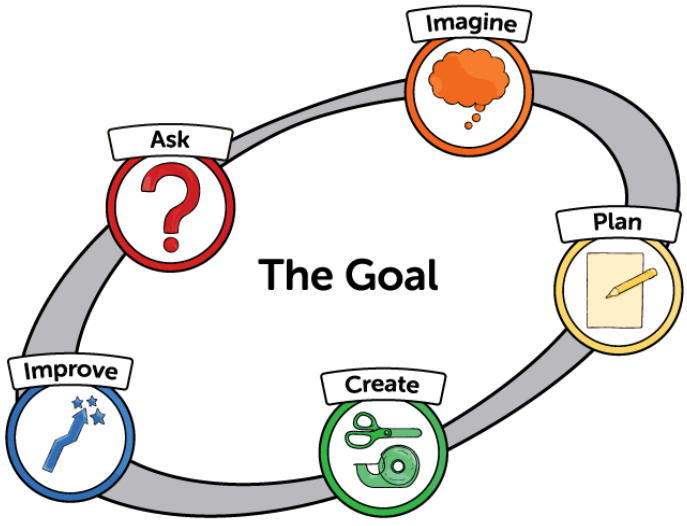
In the final week of the unit—which is also one of the final weeks of the school year—children return to *Seeds of Change: Planting a Path to Peace*. This text wraps the classroom discussion all the way back around to the beginning of the year, considering children's participation in and promotion of a healthy community. Time is also left in this week for classrooms to revisit favorite texts from throughout the year and to make robust connections among ideas and experiences children and teachers have had together.

Pollinator Project Overview

Unit 4 asks children to consider something many of us take for granted: that pollination will happen and that flowers and plants will provide the food and beauty we depend on. But what if pollination doesn't happen? How can people support the process of pollination? The Pollinator Project has three parts: one enacted through Writing, one through the Engineering Design Process, and one in Studios.

In Week 6 children learn about the problem of insufficient natural pollinators. In Week 7 they learn about community gardens to situate their projects; the audience for both the writing and engineering parts of the final project will be gardeners of a community garden.

Already in the early weeks of Unit 4, children have written reports about plants, each one with a different flower shape. In Week 6, taking up again the Engineering Design Process introduced in Unit 3, children first consider various flower shapes, and then choose one for which to design a mechanism for successfully pollinating it by hand. They endeavor to answer the question, *How can we use our knowledge of pollination, materials and their properties, and the Engineering Design Process to design and improve a hand pollinator for a model flower?**



Engineering Design Process

ASK: What is the problem? How have others approached it? What are the constraints?

IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.

PLAN: Draw a diagram. Make lists of needed materials.

CREATE: Follow the plan and create something. Test it out.

IMPROVE: What works? What doesn't? What could work better? Modify the design to make it better. Test it out.

Once children are satisfied with their designs, they write procedures (in Studios) for how to use the hand pollinators and to articulate situations that might benefit from hand pollination, such

as greenhouse growing or a drop in pollinator populations.

Meanwhile, children return to the genre of argument to persuade community gardeners about the importance of planting pollinator-friendly plants. They choose the medium—brochure, pamphlet, flyer, poster, or bookmark—to share their ideas with growers and garden coordinators. The plants children describe and recommend are ones that will grow successfully in the area and that are pollinated by local organisms.

The Final Product
Community gardeners are presented with written products—Why it's important to plant pollinator-friendly plants in various forms—along with illustrations of and procedures for different kinds of hand pollinators.

Additional Activities: Studios
The writing and engineering parts of the project proceed, as usual, in whole group lessons with small group and individual work. In addition, children may extend the project and their thinking in Studios. Consider the materials, tools, and processes that have been of greatest interest during the school year, and reintroduce those according to children's ideas for communicating their knowledge about the topic. Some ideas include:

- drawing **plans** for gardens that include pollinator-friendly plants and other practices that support pollination
- writing **procedures** for how their hand pollinators work
- writing **poems** about pollinators and/or flowers
- acting out garden scenes from the **perspectives** of gardener, pollinator, and plants
- writing and performing a **play** about the process of pollination, the loss of pollinators, or interactions among pollinators or gardeners
- creating **collages** or other multimedia artwork using seed catalogs and other art techniques explored through the year
- drawing **maps** of pollinator routes from home to plants
- representing **cycles of growth and change** of plants and/or pollinators
- composing **music** that evokes pollinators' activities
- painting a **mural** to share as a design proposal for the community garden

To support these smaller projects, host Thinking and Feedback sessions to help children refine their work and find opportunities for individuals or small groups to join efforts.

Teacher Preparation

Find a community garden near the school and reach out to a garden coordinator, manager, or gardener. Consider how the second graders' ideas can be best shared with the garden community.

Collaboration and Coordination

Identify a community garden near the school and identify one teacher as the contact person—or identify as many gardens as classrooms and find contact information for each. Alternatively, if the school maintains a schoolyard garden, whoever coordinates planting could also be a good audience for this project.

Presentation and Celebration

Invite families and other school community members to view finished work. Children may want to make a formal presentation of their arguments to support pollinators. Hand pollinators might be set up for visitors to try. Decorate with fresh flowers!

Contact someone at the community garden identified as the audience and arrange to send or deliver children's products.

Please remember to submit the children's arguments to the *Focus on Second* team, as well.

* The Pollinators Project is adapted from *The Best of Bugs: Designing Hand Pollinators*, developed by Engineering is Elementary®, Museum of Science, Boston. Used with permission.

Science and Engineering in Unit 4

While Text Talk lessons focus on the pollinator organisms, experiences during Science and Engineering lessons focus on the pollinated: the plants. In this way, children will be growing understanding about the Big Ideas through both plant and animal organisms simultaneously. How organisms grow and change, the relationship between an organism's structure and its function, and the interdependence of life forms are relevant to both, and these concepts form the foundation for this unit. Conversations and experiences will bounce back and forth between plant and animal like a complicated game of ping pong, just as happens in the natural world. Many of these connections are made explicit in the curriculum; others will arise through unique classroom conversations and experiences.

Seed and plant investigations are ongoing and will need care according to the conditions in the classroom. Throughout the unit, children can be doing two things outside formal science lessons: caring for the growing plants and recording observational drawings. Plants in soil will need regular watering and adequate sunlight. Seeds germinating in bags will need paper towels that are kept moist but not too wet. These bags should be open to allow for air circulation. It may be helpful to set up a calendar and/or jobs chart as a way to manage and remind children about plant care.

Children record their observations, findings, and questions in their Science and Engineering Packets.

Preparation notes

Collect containers for planting

Plant pots do not need to be fancy; consider recycled plastic containers such as salad boxes, pint- or quart-size round containers, and paper ice cream pints. Poke a few holes in the bottom of each container, and make sure to have something to put underneath, such as plastic lids or saucers.

As soon as possible, **start some seeds**: plant a few beans in pots with soil; germinate a few each of pumpkin, pea, arugula, and corn seeds in separate plastic bags with a wet paper towel. In addition, plant some arugula seeds in soil. Done early enough, these should flower and maybe even produce seed pods by mid-June to allow the children to see the full growth cycle of the plant. Other seeds to start in soil, plastic bags, or standing in water include avocado, mango, or any others collected at home. The greater the diversity of seeds sprouting in the classroom the

more interesting the conversation will be. Children will observe similarities and differences among the seeds and the plants' structures; this will extend children's thinking. Look online for guidance about starting and caring for specific kinds of seeds.

Once planted, seeds that sprout in pots will be continuously monitored by the children. Take advantage of opportunities to also compare differences and similarities between the growth and development of the seeds, seedlings, and plants in both pots and plastic bags so that children make note of the effects of different growing conditions.

Alignment with other components

The Science and Engineering Lessons for Unit 4 run parallel to but don't always exactly match the Weekly Questions. Look for opportunities to draw connections among components, even when the specific topic of discussion differs. Everything is connected in the end.

Posing questions, offering information: a delicate balance

In each lesson, teachers ask questions to elicit children's thinking. Don't expect precise or correct answers. Instead, use the questions and children's initial responses to guide experiences; children will record and then test their own ideas and learn from investigations over time. As children ask questions, do the needed research to learn about the topic and be prepared to offer information so that children do not continue to trip over misconceptions.

For example, in Week 2, children may wonder whether plants need dirt to grow. Rather than answering, record this question on a chart and let the children observe for a few weeks to see what happens. At that point, explain that scientists have learned through investigation that under certain conditions plants don't need dirt:

> "The keys to plant growth are a variety of mineral nutrients, including nitrogen, phosphorus, and potassium. If you can add these necessary mineral nutrients into a plant's water supply, you no longer need soil for the plant to grow. Just about any plant can be grown with hydroponics." (https://wonderopolis.org/wonder/can-plants-grow-without-soil)

The practice of observational recording

Throughout this unit, children record their close observations in drawings, measurements, and words. Make sure Observing and Recording Packets are easy for children to access independently. The record of plants' growth should be easy to follow from one page to the next, so they will record both dates and page numbers as they go through the pages; additional pages can be added as needed. It is important to set strong observational recording habits at the start. Children work in pairs as they follow the growth and development of seeds they germinate. With each observation, they first look very closely and talk together about what they notice. Then, working in pencil and colored pencil, they draw as many details as they can capture and

write some words to accompany their drawings. Drawings may be larger than life-size in order to capture details, but something on the page should indicate the actual size of the drawing's subject (scale). Finally, children write questions that arise from the observation. These questions help teachers plan lessons and informal conversations that respond to children's ideas, misconceptions, and wonder. As children do this work, teachers circulate around the room to support children's process and to pollinate ideas from one pair to another. In addition, the Discovery Studio accommodates observational recording throughout the unit, alongside other suggested activities in some weeks.

Measuring and graphing plant growth

Measuring plants as they grow offers an opportunity to meaningfully contextualize mathematical concepts. Rely on familiar approaches and resources for teaching measurement. In addition to measuring, children record plant height each time they measure to create a graph of plant growth. These graphs may be added to children's Observing and Recording Packets and/or placed near plants being watched by small groups and completed collaboratively. Additional graphing pages can be added as needed. Using the provided paper guides children to record plants' actual size in half-inch increments; representing the measurements in actual size supports children's development of understanding linear measurement.

Children measure the plant each day possible. They will record their observations during lessons in the first few weeks, and then continue to independently record their data at the Science Literacy Station. As children are making observations, they will record data by creating a graph of the length of their plants. Discuss the best way to manage skipped days, both for recording and for understanding growth. It will be useful to have a calendar close by for children to consult. See the example below.

2 ½"					
2"					
1 ½"					
1"					
½"					
Date	5/6/18		5/8/18		
Day	1	2	3	4	5

Assessment and Planning

The chart created in Science and Engineering Lesson 1 will be a living document through the course of several lessons and even the entire unit. Use this chart as a reference for discussions, to revisit old questions, and to record new questions and discoveries.

Early lessons offer opportunities for pre-assessment that can guide successive lessons. Note that questions children raise will need to be addressed in some way, even if they are not the focus of provided lessons.

Background information

Read the pages from *Botany for Gardeners* (pages 26-33, 36-38) to develop background information about seed germination and plant growth and development. Another good, short resource is found at the website You Grow Girl, Seed Starting - Germination (http://yougrowgirl.com/seed-starting-germination/).

Germination

Seeds have all the nutrients inside them needed to sprout. When seeds are soaked (or naturally, when spring brings thawing and moisture to seeds underground), they absorb nutrients from the water. These nutrients allow for the reproduction of cells and set the growth process in motion. This process was dormant when the seed did not have favorable conditions to germinate (as with the dry seeds that arrive in seed packages). For germination, different types of seeds need different formulas of the same conditions: warm temperatures, nutrients from water, and air. The children test these conditions as they set up germination experiments in Week 1.

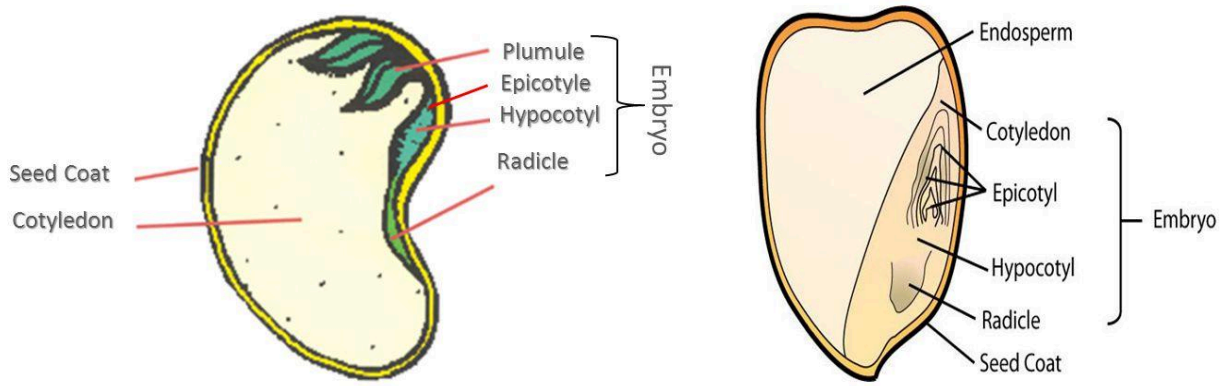
Plant Development

From a seed, roots develop first, so that the developing plant can soak up water, where essential nutrients are found. Seeds and roots do not need sunlight (consider their location underground); the plant begins the process of photosynthesis once it has sprouted out of the ground, and it develops leaves for this purpose. A key understanding is that **plants make their own food** through the cyclical process called photosynthesis. The plant absorbs sunlight, water, minerals, and carbon dioxide through stomata—small holes on the undersides of their leaves. These elements are used to make glucose, the energy or food that the plant requires.

Pollination is critical for plant *reproduction*, or the development of new seeds; pollinators are helping themselves by feeding on nectar and collecting pollen. Most plants are not dependent on any other organism for food or growth.

Parts of a Seed (Week 2)

Children look inside seeds to discover the parts that will grow into plants. Some seeds' structures will be easier to see than others. In both types of seeds, dicots and monocots, the four parts crucial for these lessons are the **seed coat** (outer protective covering while the seed is dormant), **embryo** (all the characteristics of a complete plant, ready to sprout in the right conditions), and **cotyledon/endosperm** (food supply for the growth of the embryo). In Week 3, children also learn about the **radicle** (part of the embryo from which the roots develop). As the bean plant grows, the cotyledon splits and seems to travel up the stem of the plant as it emerges from the soil. Children observe as these change: they eventually shrivel up as the plant develops true leaves and begins photosynthesis, no longer needing the nutrients originally stored in the cotyledons. Some seeds, such as corn, are monocots and have a slightly different structure.



dicot seed monocot seed

http://slideplayer.com/slide/5661370/, http://slideplayer.com/slide/5661374/

Roots (Week 3)

Roots are the first part of the plant to develop. Once they observe this, the children are invited to wonder why it is so. This leads to the understanding that the first thing a plant needs is water and its nutrients. Everything else it needs is in *itself*.

The function of roots is to collect water and nutrients. Roots grow in order to absorb more nutrients from their environment. Plants have many and long roots so they can store water and nutrients when it doesn't rain for a period of time. In addition, roots help anchor the plant in place (and thereby, as discussed in Unit 2, helps prevent erosion).

An outside area with weeds—along the playground or in the schoolyard garden or outdoor classroom—offers the opportunity for children to pull up a few plants and see different types of roots firsthand and then consider how they absorb water and hold a plant in place.

As the weeks progress, children will explore the various parts of the plants as they develop: stem, leaves, flowers, and perhaps seed pods.

Designing and Constructing Hand Pollinators

Read the Pollinator Project Overview for information about the Unit 4 project, including designing, building, and testing tools for picking up and depositing pollen by hand.

Studios At a Glance	Unit 4: The Power of Pollinators

	Art 	Building 	Discovery 	Math 	Research 	Writing & Storytelling  
Week 1 What is important about seeds?	Children consult the illustrations in *Cuckoo* and images of Mexican folk art. They discuss colors, shapes, and themes and then create their own designs.	Children work with K'NEX to build flowers, including as many parts as possible. They consult images and texts and practice relevant vocabulary.	Children look closely at seeds and discuss and record what they find. Children watch and discuss the video from Text Talk, Day 3.	Game: Target Numbers	Children continue research begun during Day 4's Writing lesson.	Children draw on the book and on their own experiences to tell, enact, write, and illustrate stories.
Week 2 What do plants need to reproduce?	Continue from Week 1	Continue from Week 1	Children observe the seeds started in Science. They might start seeds brought from home.	Game: Five in a Row	Continue from Week 1	Continue from Week 1
Week 3 What do bees need to survive?	Children create shadow puppets of characters for stories about pollination. They may build a puppet theatre.	Children look at images of beehive designs from around the world and build models of them.	Children continue seed and plant observations. Children look at and talk about and compare images of roots.	Game: Target Numbers	Children listen to music and draw in response. Children write fact boxes to add to the book *Flight of the Honey Bee*.	Children use the puppets they create in the Art Studio to perform pollination plays.
Week 4 How does	Children create prints inspired by illustrations in *The*	Children build pollinators, with attention to body	Children continue seed and plant observations and	Game: Write the Number	Children research pollinators of particular interest.	Children write poems and continue to develop

pollination happen?	*Little Hummingbird*.	parts.	with work from Science Lessons (Leaves).			pollination plays.
Week 5 What makes a plant and a pollinator a good match?	Continue from Week 4	Continue from Week 4	Continue from previous weeks and with work from Science Lessons (Flowers)	Game: How Close?	Continue from Week 4	Continue from Week 4
Weeks 6-7 Why is pollination important to people and other animals?	In all studios, children continue exploring unit themes and contribute to the Pollinator Project, according to the class Project Plan and their own smaller project ideas, and drawing on all the texts and other resources from the unit. In these last weeks of the school year, studios are flexible and open in order for children to access and productively use any materials and processes explored thus far for work of their own design, as well as for the Pollinator Project.					
Week 8 How do I and how do we contribute to our communities?	Studios run for two days in Weeks 6 and 8 to allow for three Engineering Lessons for designing and building hand pollinators.					

Writing: Introduction to Report

Report is a genre of writing that shares features with procedure and explanation, although it is not organized chronologically. Over four weeks, children continue their study of report from Unit 2, going deeper into a report's structural and language features, and writing brochures about local plants. These plant reports prepare children for learning later in the unit, including designing hand pollinators in Science and Engineering and writing arguments.

Purpose

The **purpose** of reports is to organize information about a topic. The organization of the information is dependent upon the chosen medium. In Unit 4, the children write brochures that present subtopics through labeled diagrams and short paragraphs.

Structure

Reports unfold in two **stages**. They begin with a **general statement**, which introduces the **topic** of the text. The body of report is made up of **subtopics**, information grouped together and ordered in a way that makes sense to the reader. An important distinction to make is that subtopics are not arranged chronologically. Reports sometimes end with a **summarizing comment**, but this is optional. In Unit 4, children are not encouraged to write a summarizing comment.

Language

Children learn to write in **third person**, to produce an authoritative and more formal voice.

Because the children report on whole classes of plants, they write with **general nouns**, naming, for example, cardinal flowers, rather than a particular cardinal flower.

In Unit 4, children continue to use **adjectives** to pack information into a sentence.

Mentor Texts

Included in this Unit:
Amazing Bees by Sue Unstead
What is Pollination? by Bobbie Kalman
Animal Pollinators by Jennifer Boothroyd

From Unit 2:
Earth's Landforms and Bodies of Water by Natalie Hyde

Vocabulary

adjective: a word or phrase used to describe a person, place, thing, or idea
classify: to assign to a class or category
feedback: specific, helpful suggestions given to improve work
general: naming a group; not specific
general statement: the beginning of a report, which introduces and classifies the topic
genre: a type of writing
heading: the title of a section of the text
image: a representation of something in the form of a drawing, photograph, etc.
information: facts or details about a subject
layout: the organization of a page
noun: a word that names a person, place, thing, or idea
organize: to arrange
publish: to prepare writing for an audience
purpose: the reason for doing or creating something
report: a genre of writing whose purpose is to organize information about a topic
revise: to make changes to writing
series: a group of things that are related or go together
stages: the parts of a piece of writing
subtopic: a smaller part of the topic
summarizing comment: the final statement in a report
the third person: writing that uses pronouns like *he*, *she*, *it*, or *they*
title: the name of a piece of writing
topic: what the writing is about

Adapted from Brisk, M.E. (2015). *Engaging students in academic literacies*. New York, NY: Routledge.

Writing: Introduction to Argument

Over four weeks, children continue their study of argument from Unit 1, deepening their understanding and skills. As part of the Pollinator Project and related to their report brochures, children write arguments convincing community gardeners to plant for pollinators. Building on experiences in previous units, the children are guided to choose the medium for their writing. They may choose to argue to community gardeners through a bookmark, brochure, flyer, letter, poster, or poem.

Audience plays a significant role in argument writing, influencing every aspect of the argument. In this unit, community gardeners are identified as the audience, and the argument is written with them in mind.

Purpose

The **purpose** of arguments is either to convince someone *to do something* or to convince someone *about something*. In Unit 4, children convince someone *to do something*.

Structure

Arguments unfold in four **stages**. They begin with the **thesis**, which is the part of the argument that states what the writer or speaker is trying to convince someone to do or think. **Reasons** support the thesis. They should be varied and appeal to the audience. **Evidence** supplies facts and details to support the reasons. Children draw evidence from unit texts and brochures. Arguments end with a **reinforcement of the thesis**, in which the thesis is repeated, but in a new way.

Language

Continuing from Unit 1, children explore the use of **adjectives** to strengthen their argument. They generate positive and negative adjectives related to their chosen reasons. They then generate closely-related words and order them according to intensity.

Mentor Texts

Included in this Unit:

Flight of the Honey Bee, Raymond Huber
Amazing Bees, Sue Unstead
"Monarch Larva Monitoring Project" brochure

Vocabulary

adjective: a word or phrase used to describe a person, place, thing, or idea
appeal: to be interesting
argument: a genre of writing whose purpose is to convince someone to do something or about something
audience: an individual or group for whom a piece of writing is composed
convince: to persuade
evidence: facts and details used to support reasons in an argument
feedback: specific, helpful suggestions given to improve work
genre: a type of writing
image: a representation of something in the form of a drawing, photograph, etc.
layout: the organization of a page
medium: a form of communication
negative: not good
positive: good
purpose: the reason for doing or creating something
reason: why the audience should do or think something
reinforcement: saying again, in a new way
revise: to make changes to writing
revision: change made to improve writing
stages: the parts of a piece of writing
thesis: the part of the argument that states what the writer or speaker is trying to convince someone to do or think

Adapted from Brisk, M.E. (2015). *Engaging students in academic literacies*. New York, NY: Routledge.

Dear Families,

Our final study in second grade is called **The Power of Pollinators**. For the rest of the school year, your children will be learning about plants and flowers, about the insects and other animals that pollinate flowers, how this works, and why it is so important.

Pollinators live all around us. This spring, look for birds, bees, and butterflies as they move from flower to flower. What are they really doing? Why are they doing it? How does it impact the plants they visit? At school we will read stories and lots of informational books to learn about what's going on; we will also watch some videos to give us a close-up view of pollination. We'll see how some flowers and some animals are perfectly matched for pollination to happen—how they are interdependent.

Our first two books will be a folktale from Mexico (*Cuckoo* by Lois Ehlert) and an informational book about how plants grow (*From Seed to Plant* by Gail Gibbons). These books will help us think about seeds. That's where everything begins! We'll start planting some seeds in our classroom right away.

Bees and apples go together. Why? We'll learn about how apple trees depend on bees in order to produce fruit, and about bees and apples. After we understand the basic way pollination works with bees and apples, we'll study other pollinators and plants. In Week 5 we'll ask, *What makes a plant and a pollinator a good match?*

In the final weeks of our study, we'll explore gardens.

As we read to learn about plants during Text Talk, we'll be growing them in the classroom, looking at the different parts of the plants and thinking about the function or job of each

At home you could...

If you have any space to grow plants where you live, this is a perfect time to get some seeds and start planting!

Look at seed catalogs (online or from a local hardware store) and choose what you would like to plant.

Collect some recycled containers for growing plants indoors. Yogurt containers, salad boxes, and take out containers all work well.

Tell a true or imagined story about how a plant grows. Or talk about a garden you have grown. Why did you choose certain plants to grow? To eat them? Because they are beautiful?

Write a list of questions you have about pollinators and pollination, and then try to answer one by doing research online or at the library.

Explore your area/town. Can you find any fruit trees? Any gardens starting?

Choose one plant inside or outside to observe.

part to help the plant grow and reproduce. Observing the plants very carefully, measuring their growth, and recording what we find will be an important part of our study.

Every few days, make a careful drawing of it. Write down what you notice, along with any questions you have about how it is growing.

How can people help pollinators thrive? Sometimes pollinators are scarce, and people step in to do some of the pollinating by hand. During our Pollinator Project's Engineering lessons, the second graders will design and build tools to do this work.

As gardens start sprouting, walk through a local garden. What plants can you identify? What do you imagine the gardens will look like in summer?

Through writing, they will also let other people in the community know how important it is to grow plants that attract pollinators. They'll write reports about pollinator-friendly plants and give them to local gardeners.

Ask your child: What are three things you might tell someone about pollinators and pollination?

All through the unit in Studios, children will work with different kinds of materials to express their ideas about seeds, plants, bees, and other favorite pollinators. They might build different kinds of beehives, design gardens, make puppets to act out stories with pollinators and flowers as characters, and make collages and prints inspired by books we read. Our Family Links will have more ideas for things you can do together at home to explore pollination and pollinators!

Books we'll be reading in Unit 4: The Power of Pollinators

Find them at the library!

Cuckoo, Lois Ehlert
From Seed to Plant, Gail Gibbons
What is Pollination?, Bobbie Kalman
Flight of the Honey Bee, Raymond Huber
Amazing Bees, Sue Unstead
Animal Pollinators, Jennifer Boothroyd
The Little Hummingbird, Michael Nicoll Yahgulanaas
What If There Were No Bees?, Suzanne Slade
Bee, Britta Teckentrup
Are We Still Friends?, Ruth Horowitz
Seeds of Change: Planting a Path to Peace, Jen Cullerton

Unit 4 Weekly Words

Weekly Words are denoted with * where they appear in Text Talk vocabulary lists.

Week 1	**become**: to begin to be **contain**: to hold within **land** (v): to arrive on the ground or other surface **mineral**: a substance in the earth that is not from an animal or a plant and that contains nutrients **ripen**: to become ripe or ready **scatter**: to disperse, to toss or go in different directions **scorched**: burned **shoot**: a new plant or branch
Week 2	**attract**: to interest, to draw closer **benefit**: something positive, an advantage **depend**: to rely on, to trust **fertilize**: to make able to produce babies, seeds, fruit, or eggs **interdependent**: relying on each other **provide**: to give what is needed, to supply **release**: to let go **rely**: to trust or depend on
Week 3	**convert**: to change into another form or state **flick**: to move with a swift and jerky motion **groom** (v): to make clean and neat in appearance **marking**: a pattern of marks or coloring on a plant or animal **navigate**: to find one's way to, around, or through **pluck**: to pick off **plunge**: to push into something **wear out**: to use until no longer useful
Week 4	**brilliant**: very shiny or bright, glittering; extremely wonderful or well done **buzz** (n): a soft, low hum; (v): to produce a low, soft hum **ecosystem**: a group of animals and plants living in one place and impacting each other **effective**: producing a good or positive result

	extraordinary: very unusual, wonderful **lure**: to attract **match**: a person or thing that relates to another as an equal in a particular way **protein**: a substance that gives energy and is essential for life
Week 5	**disperse** (n: dispersal): to scatter **essential**: necessary, needed **locate** (n: location): to find the position or place of **mutual**: done by each for the other; having the same relationship toward each other **slurp**: to noisily suck food or drink **species**: a group of living things (that can mate with one another but not with those of other groups) **spread**: to scatter or send out **transfer**: to move or carry from one place to another
Week 6	**critical**: very important **damage** (n): harm that makes something less valuable; (v): to do harm **evolve**: to develop over time **extinct**: having no living examples, such as an animal or plant **food chain**: a series of organisms, each dependent on the next as a source of food **legislation**: the process of passing laws **nourishment**: food or other substances needed for health and growth **pesticide**: a substance used to destroy insects that are harmful to plants
Week 7	**commitment**: dedication to something or to an idea **local**: having to do with a particular place close by **organization**: a group of people working together for a shared purpose **plot**: a small piece of land **public**: open to all **restore**: to return to an earlier condition **trace**: a very small amount of something; a mark or sign of something **wildflower**: flower that grows without planting or care by people
Week 8	Selected by teacher for review

Science and Engineering

Unit 4:
The Power of Pollinators

Name: _____

Assessing my work

Scientists and engineers ask themselves questions about how they are working to make sure they are doing their very best work.

How did I use my five senses to gather information about an object or something that happened?

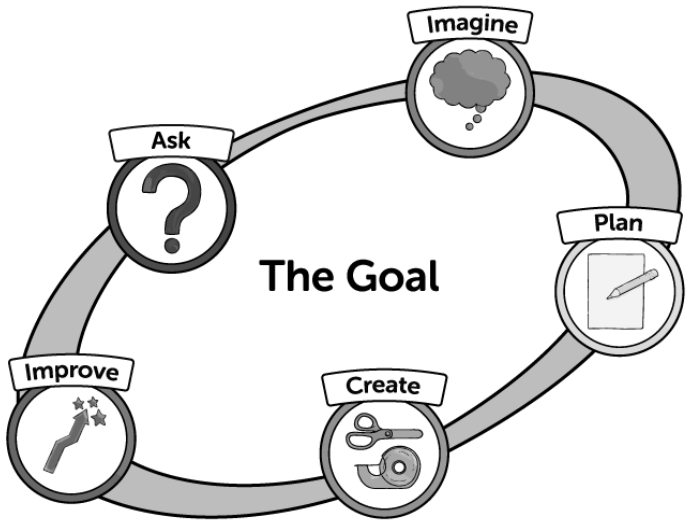
Did I draw or write what I thought or observed?

Did I ask a question about what I noticed to get more information?

How did I share science and engineering ideas?

Did I talk, write, draw, or build something?

Where am I in the Engineering Design Process?



Engineering Design Process

ASK: What is the problem? How have others approached it? What are the constraints?

IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.

PLAN: Draw a diagram. Make lists of needed materials.

CREATE: Follow the plan and create something. Test it out.

IMPROVE: What works? What doesn't? What could work better? Modify the design to make it better. Test it out.

Date: _____

Observing Plants

Question: _____

_____

Observations:

_____

_____

_____

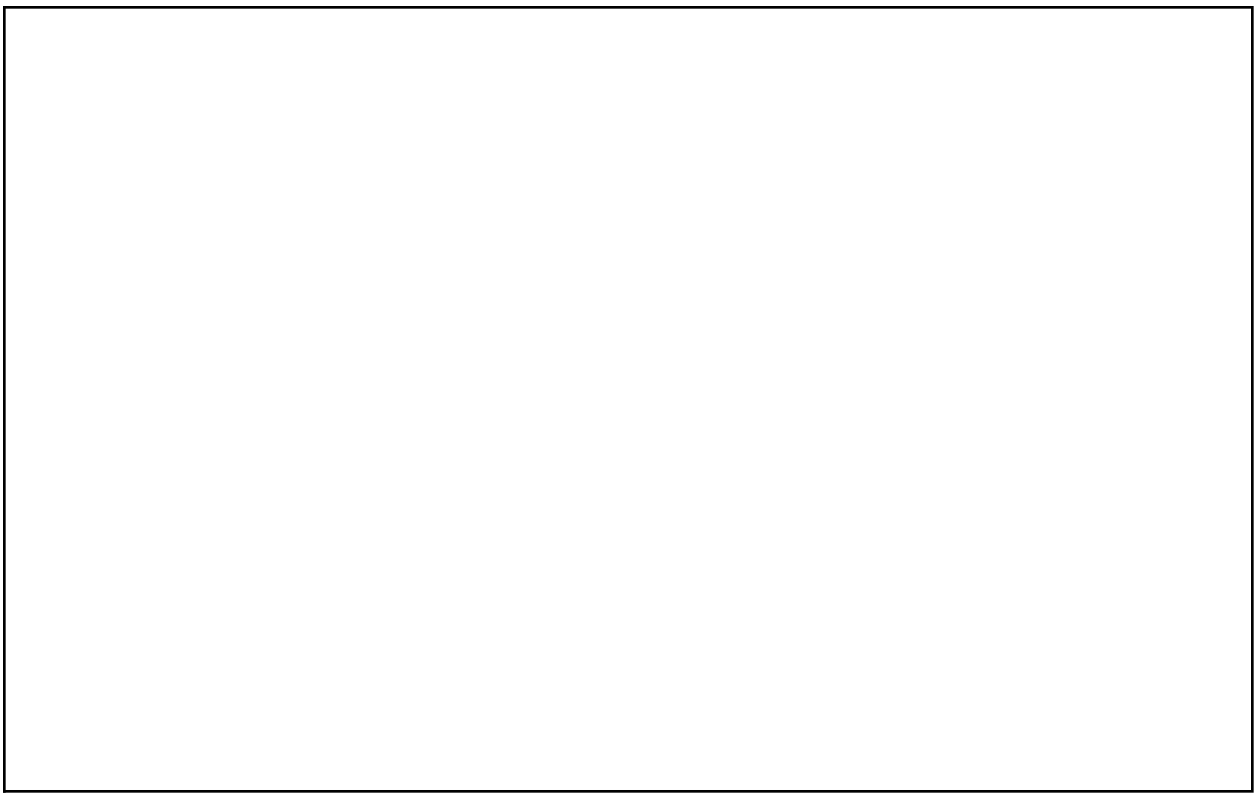
Date: _____

What conditions do seeds need to germinate?

Question: Do seeds need _____ to sprout?	
How we are testing this question:	
Drawing 1	Drawing 2
Prediction: _____ _____ _____ _____	Prediction: _____ _____ _____ _____

Date: _____

Write and draw about seeds you have noticed at home or in school. Are they seeds you can eat? Can you plant them? What else can you do with seeds?



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Date: _____

"The Beauty of Pollination" video

What do you notice now that you did not notice the first time you watched the video?

_____

_____

_____

Why is this important?

_____

_____

_____

Draw a picture to represent a key detail of this video.

Date: _____

What's inside a seed?

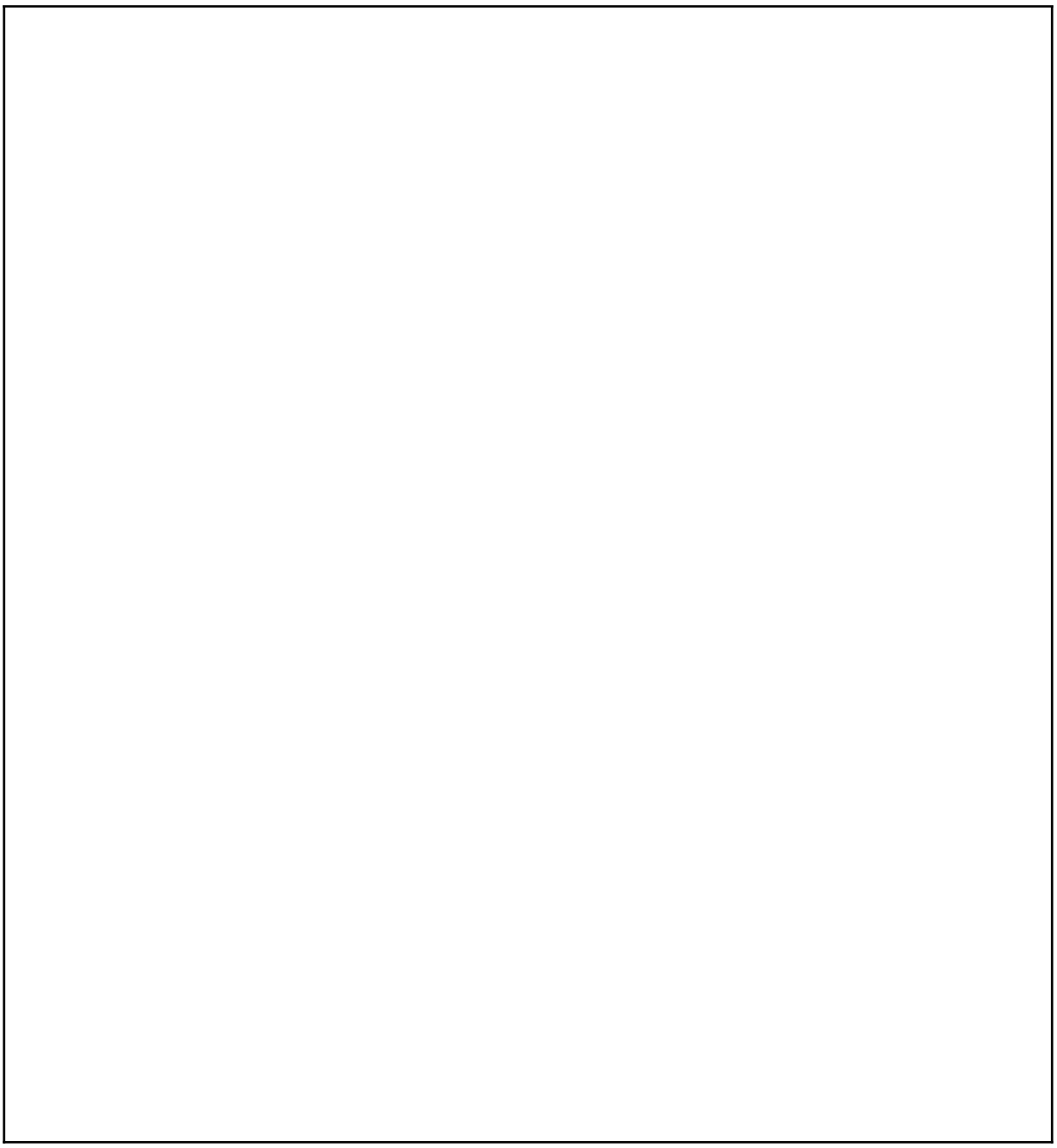
Kind of seed: _____ Observations: _____ _____ _____	Kind of seed: _____ Observations: _____ _____ _____
Kind of seed: _____ Observations: _____ _____ _____	Kind of seed: _____ Observations: _____ _____ _____

Questions: _____

_____

_____

The Parts of a Bean Seed



Self-assessment:

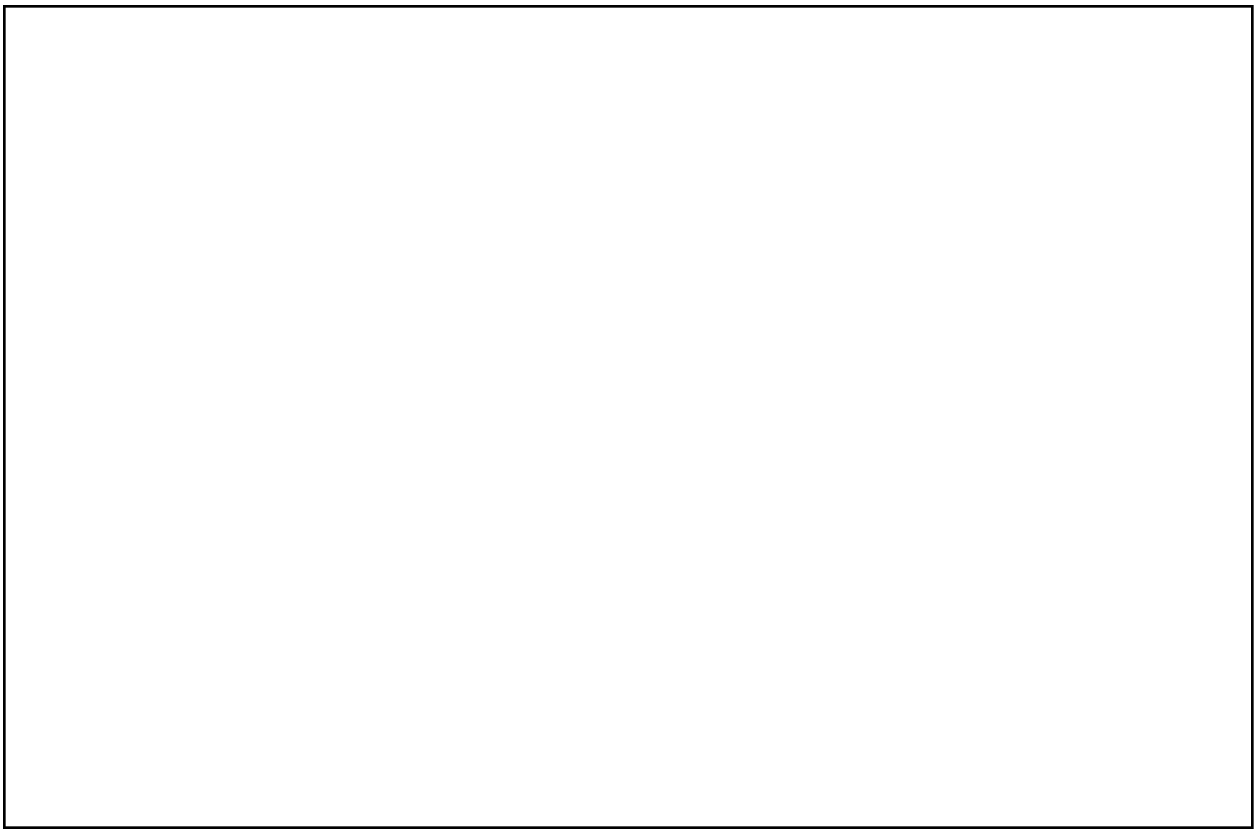
Did I use my five senses to gather information about an object?

Did I draw or write what I observed?

Did I share science ideas by talking, writing, or drawing?

Date: _____

Why do you think many seeds start growing in the spring?



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Additional page

Date: _____

Observing Plants

Question: _____

_____

Observations:

Length:

_____

_____

_____

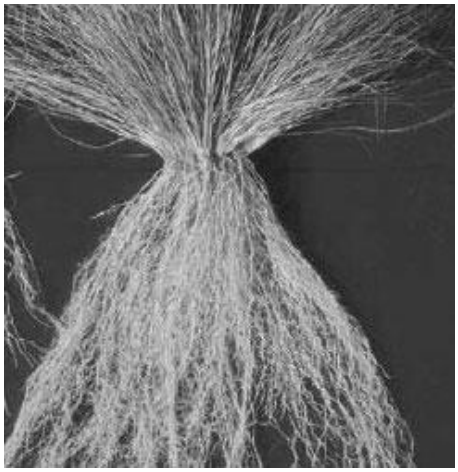
Date: _____

Quadrat Study 7

Draw what you see in your quadrat. Pay close attention to any plants.

All about Roots_____Date: _____

Look at the images and think about the questions below.



How can you describe these roots?

What is the same about these roots and other ones we see?

What is different about these roots from other ones we see?

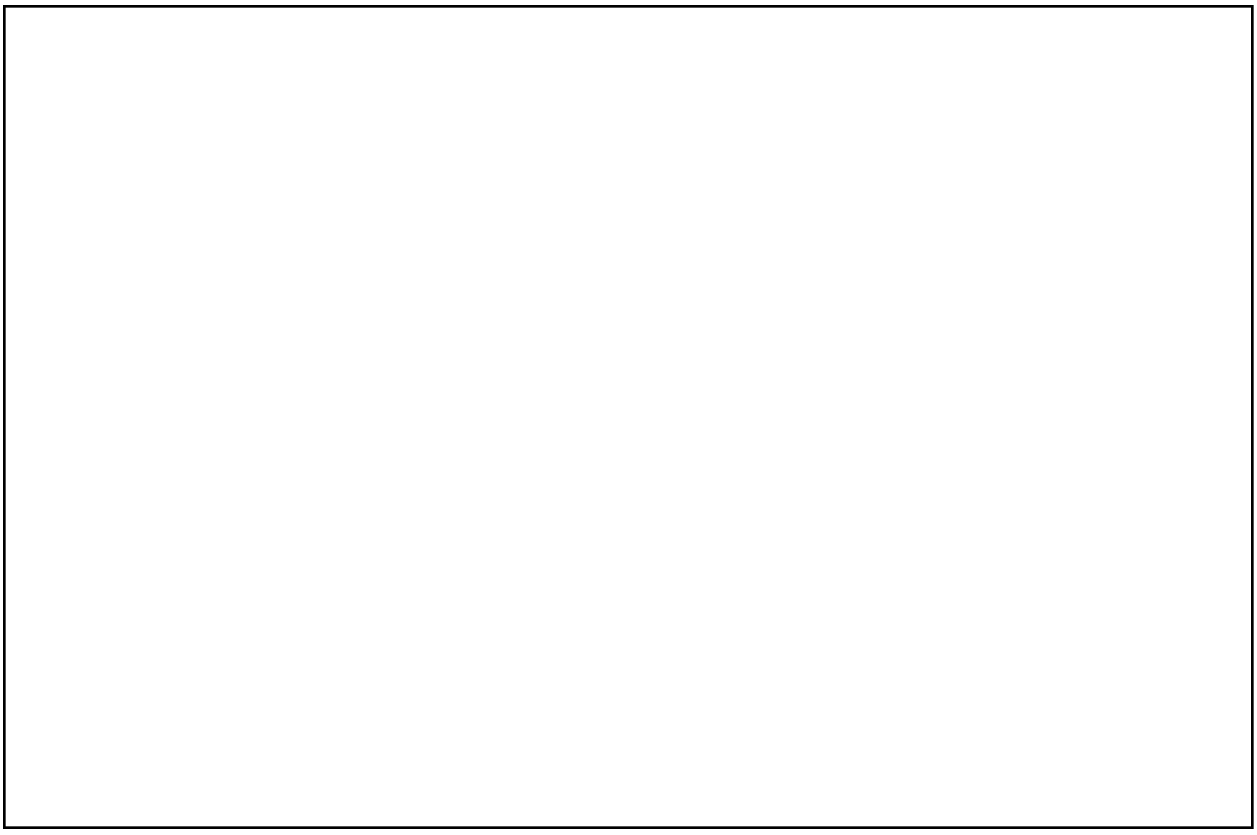
Why might these roots be shaped like this?

Where would a plant with roots like these likely grow?

Could we eat these roots?

Date: _____

How have your seeds changed?



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Date: _____

Observing Plants

Question: _____

_____

Observations:

Length:

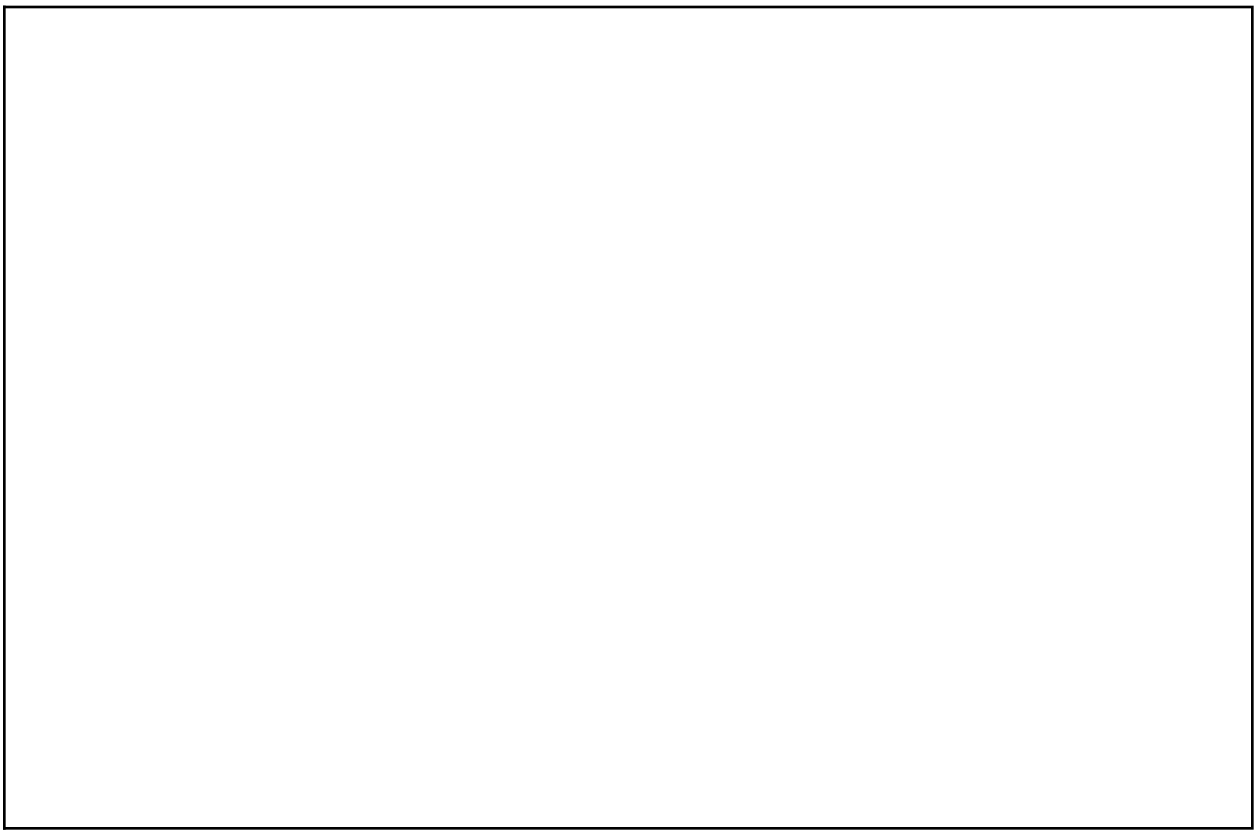
_____

_____

_____

Date: _____

Do you notice any new leaves growing on the trees outside our classroom? Write and draw about them.



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Date: _____

Parts of Flowers

Flower 1	Flower 2

What **differences** do we notice? _____

_____

_____

_____

What **similarities** do we notice? _____

_____

_____

_____

Date: _____

Inside Flowers

Flower 1	Flower 2

What **differences** do we notice? _____

_____

_____

_____

What **similarities** do we notice? _____

_____

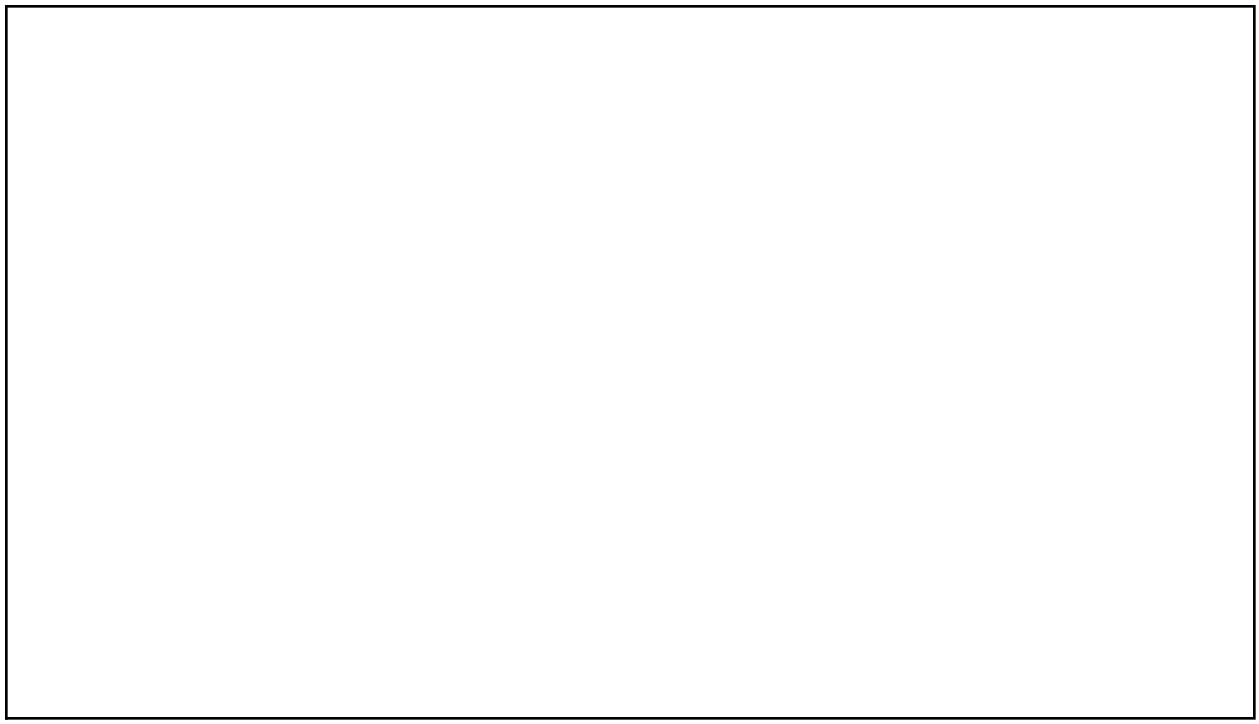
_____

_____

Date: _____

Looking for Evidence of Insects

What insects and small creatures are living around our school? What evidence did you find? What in the environment do these organisms depend on?



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Date: _____

How have our classroom plants changed? Measure and graph your plants. Record your observations.

_____

_____

_____

_____

_____

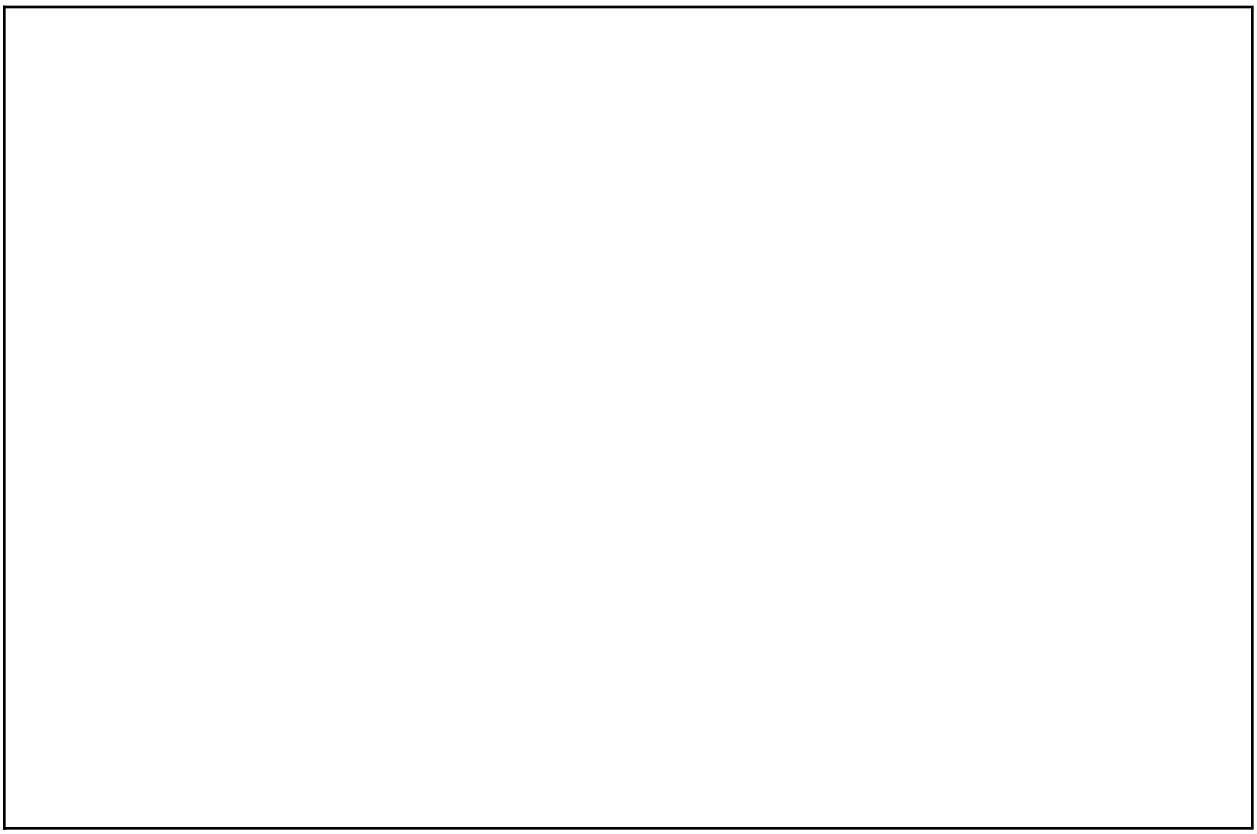
Date: _____

Quadrat Study 8

How have the plants changed? Do you see any new plants? Choose a few plants to draw. Is there evidence of other organisms in the quadrat?

Date: _____

How have our classroom plants changed? Measure and graph your plants. Record your observations.



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Date: _____

Properties of Materials for Hand Pollinators

What materials work best for picking up and depositing pollen? What are their properties?

Best Materials	**Properties**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Illustrations to support my ideas	

Date: _____

"Ask"

Draw and label your flower and the model of your flower.

Where is the pollen located?

_____

What materials could you use to pick up and deposit pollen?

_____

_____

How might you test your hand pollinator?

_____

_____

 Date: _____

"Imagine"

Sketch some ideas for a hand pollinator for your model flower. Make sure to include the materials you would use.

This flower is _____.

1	2
3	4

 Date: _____

"Plan" Draw the design that you and your partner agree is the best.

This flower is _____.

The materials we will use are

_____

_____

We think this design will work best because

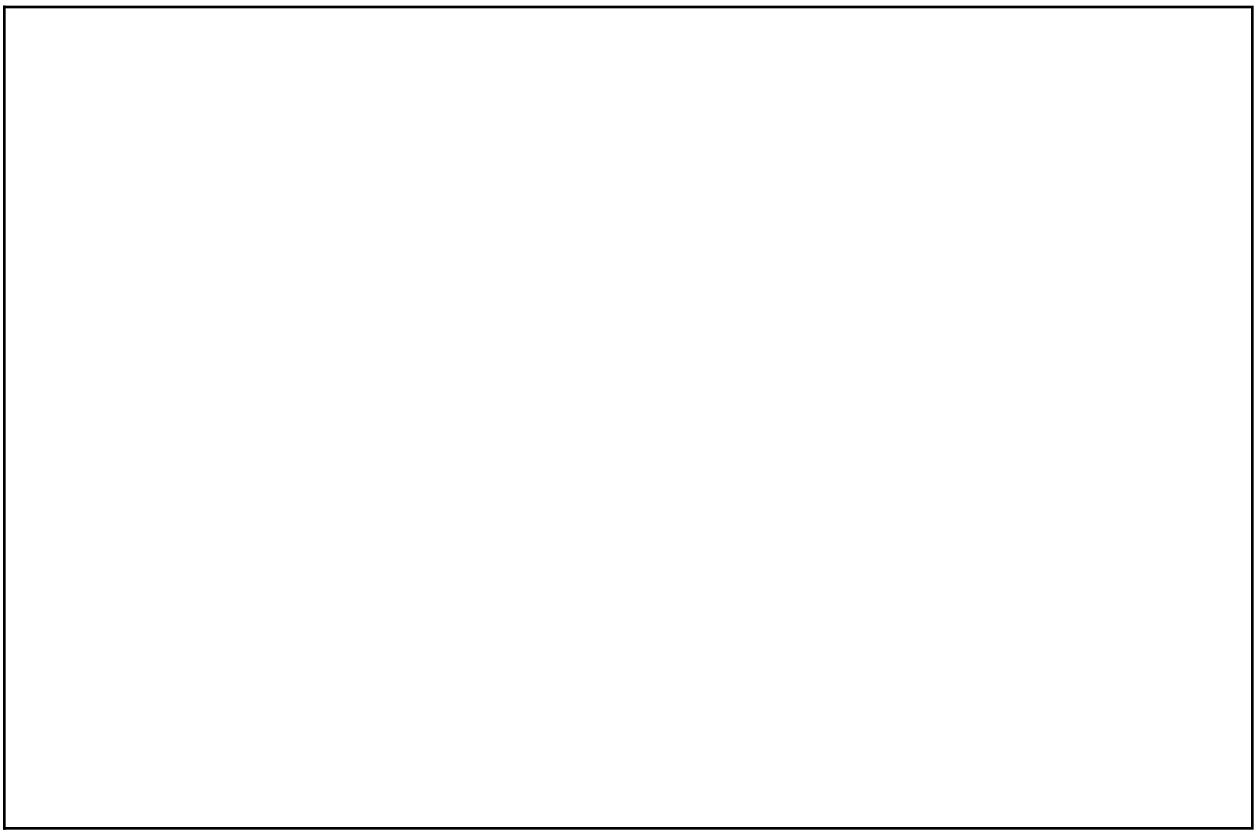
_____

_____

_____

Date: _____

How have our classroom plants changed? Measure and graph your plants. Record your observations.



_____

_____

_____

_____

_____

Date: _____

I am designing a hand pollinator for _____.

How much pollen did your design pick up? Circle one answer.

a lot a little bit none

How much pollen did your design drop off? Circle one answer.

a lot a little bit none

What parts of the pollinator worked well?

_____

_____

_____

_____

What parts of the pollinator did not work well?

_____

_____

_____

_____

Date: _____

"Improve" What are some ways you could make your hand pollinator design work better?

_____

_____

_____

Draw and label the improved design.

Date: _____

How have our classroom plants changed? Measure and graph your plants. Record your observations.

Predict: What might happen with the plants next?

Additional page

Date: _____

Observing Plants

Question: _____

_____

Observations:

Length:

_____

_____

_____

What is important about seeds?

What do plants need to reproduce?

What do bees need to survive?

How does pollination happen?

What makes a plant and a pollinator a good match?

Why is pollination important to people and other animals?

How do I and how do we contribute to our communities?

Unit 4 Observation Notes **Date:**

Big Ideas	**Guiding Questions**
Organisms in an ecosystem are interdependent. Living things grow and change over time. The parts of an organism have specific functions. Pollination is a result of animal behavior. Animals, including humans, benefit from and depend on pollination.	What makes particular organisms interdependent? Why is it important to understand how living things grow and change over time? Why are the particular parts of an organism important? What can we understand about how organisms benefit each other? How does pollination happen? Why is pollination important to people and other animals?

Art	Building	Discovery	Research	Writing & Storytelling	

Children present

Questions/Focus

Observational Notes

What is going on here?
What feels surprising about this moment?
What does this tell me about what the children know and care about?

Observational Notes, continued

Reflection

What similarities/trends do I notice?
What surprises me?
What do these observations seem to suggest?
What else might be going on?

Next steps

What else do I want to observe or find out?
What resources will I need?

Parts of a Flower