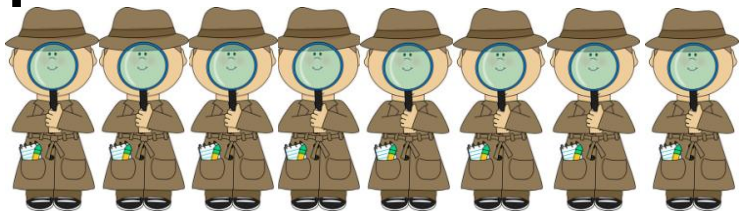
Plants Week 8 Booklet

- Living vs. Non-Living
- Foss Investigation #6 Plant Reproduction & Growth
- Part 1: Lima Bean Dissection
- Part 2: Environmental & Genetic Factors
- Part 3: Flowering Plant Reproduction

Not in Foss-

- Plant Tropisms



Tropism & Experimental Design Vocabulary

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Word	Definition
1. Tropism	Plants respond to changes in the environment by growing their stems, roots, or leaves toward or away from the stimulus. This response, or behavior, is called a tropism.
2. Phototropism	The way a plant grows or moves in response to light.
3. Gravitropism or Geotropism	The way a plant grows or moves in response to gravity.
4. Hydrotropism	The way a plant's roots grow or move in response to water.
5. Thigmotropism	The way a plant's leaves or stems grow or move in response to touch. Examples: Venus Flytraps, Mimosa Pudica (Touch-Me-Nots)
6. Independent Variable	The factor that can be changed in an experiment, the one that "I CHANGE." *MIX-Manipulated, Independent Variable on the X-Axis*
7. Dependent Variable	The results in an experiment. This is the responding variable. *DRY-Dependent, Responding Variable on the Y-Axis.*
8. Control Group	The group that does not receive the change or experimental variable.
9. Experimental Group	The group that receives the change or experimental independent variable.
10. Environmental Factors	Conduct investigations to determine ways that air, water, light, minerals, or space affect flowering plants.

Focus Question: How do the structural adaptations of seeds help them to survive?

Lab Part 1: Lima Bean Dissection

You have been considering how plants get the water and energy they need to live. Now we are going to explore where plants come from. Refer back to your Evidence of Life Sheet. Think about what evidence you have that plants are living organisms and that seeds are living. Today we are going to investigate lima bean seeds. What do we mean when we say seeds are dormant? _____

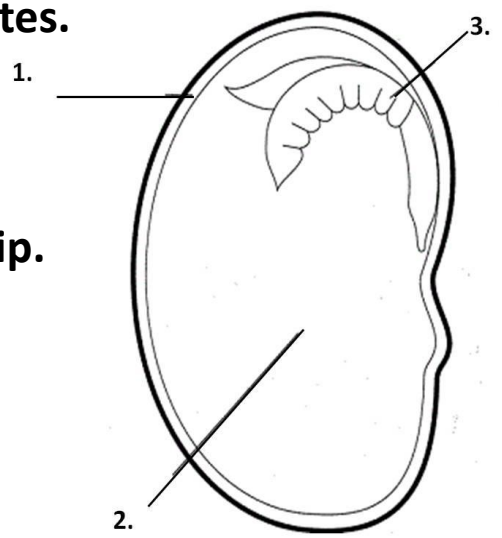
What is an adaptation? _____

What structures do these seeds have that help them survive, come out of dormancy, and grow into bean plants? _____

1. **You will get two seeds that were bought at the grocery store. One is dry and one that we will soak in our mouths for 5 minutes.**
2. **You will draw and label the inside and outside of the dry bean, while you are soaking the other bean in your mouth for 5 minutes.**
3. **You will receive a paper clip, open one side (see below) to use as a probe and gently open and draw the parts of the split soaked bean from your mouth.**
4. **Have a "getter" collect the beans (2 for each student), a hand lens and a paper towel for each student to dissect their beans on.**

Lab Part 1: Lima Bean Dissection (continued)

On Lab Sheet #48



a. Place one of the lima bean seeds in your mouth for 5 minutes. While you do this, continue with the steps below.
b. Draw or trace the outline of the DRY lima bean seed.
c. Carefully chip the white seed coat off the DRY seed all the way around the edge with the point of the paper clip.
c. Carefully split the DRY seed in half. This is challenging!
d. Use a hand lens to observe the interior of the DRY seed. Using colored pencils or crayons draw what you see inside.
e. Label the parts of the seed on the right.
f. Now take the soaked seed from your mouth.
g. What do you notice is different about this SOAKED seed?_____
h. Complete steps b-d above with the SOAKED seed. Be very careful with this seed as it is wet and may fall apart very quickly. Try not to damage the parts of your seed.
i. What new structure did you find in the moist seed?_____
j. What do you think it is? _____
k. Discuss for one minute about the three structures of the seed you have observed. How does each structure help the seed to survive? Revisit Living/Nonliving Card Sort.

1. Seed coat-_____.
2. Cotyledon(s)-_____.
3. Embryo-_____.

Answer any remaining questions on Lab Sheet #48 & return lab materials and go back to answer the Focus Question: How do the structural adaptations of seeds help them to survive?

Seed Dissection

***Dry* seed dissection: Draw and label what you observe.**

Outside of seed	Inside of seed

***Soaked* seed dissection: Draw and label what you observe.**

Outside of seed	Inside of seed

Answer these questions in your notebook.

1. How is a seed protected during dormancy?

2. If a seed did not have cotyledons, what would happen?

3. Why do you think the ability to produce seeds is an important adaptation for flowering plants?

LAB: Part 1-Lima Bean Dissection (optional idea at end of experiment, |you can plant a seed)

LAB: Part 1-Do Database Seed Collection then this Homework Activity

Due Date: ____________

SEED HUNT

Collect one or two of as many different kinds of seeds as you can find. Look for seeds from grasses, trees, bushes, fruits, vegetables. Use transparent tape to tape the seeds on the sheet. Label each seed with where it came from and how you think it moves away from the parent plant (how the seed disperses).

1 Taken from: Dispersal method:	2 Taken from: Dispersal method:	3 Taken from: Dispersal method:	4 Taken from: Dispersal method:
5 Taken from: Dispersal method:	6 Taken from: Dispersal method:	7 Taken from: Dispersal method:	8 Taken from: Dispersal method:

Focus Question: How do environmental factors affect the germination and early growth of different food crops?

Lab Part 2: Environmental and Genetic Factors

Review transpiration: Do all the cells in a multicellular plant need water? Circle Yes or No
How do the cells in a plant get the water they need?_____
Think back to the five-material investigation at the beginning of the unit. What do you think might happen to plants germinating and growing in water that is affected by salt (salinity).
Look back in your notebooks to the five materials we investigated.
What was the most suitable environment for radish seeds? _____
Is salt water a suitable environment for growing radish seeds? Circle Yes or No
What was your evidence? _____
THINK: The saltwater used in that investigation had approximately the same amount of salt as average seawater. Might the seeds have germinated in salt water that wasn't as concentrated (strong)?_____
We tried only radish seeds, What might happen to other plants at the same concentration of salt? _____
We will be starting an investigation to see how different kinds of seeds are affected by different levels of salinity meaning different concentrations of salt (sodium chloride, NaCl) dissolved in water. You will explore how changing salinity affects the germination and early growth of four important food crops: wheat, barley, oats and corn. You will find out if any of the crops are salt tolerant, that is, if they can grow in saline environments.

Lab Part 2: Environmental and Genetic Factors

THINK about the focus question. How do environmental factors affect the germination and early growth of different food crops?

Teacher will show students the cups prepared for them with the different seeds. Project Master EE Grains. These are all important grains that are eaten in many places around the world. Put an "X" in each box of the grain that you have eaten before. Though many people consider corn a vegetable, it is actually a grain.

Wheat	Barley	Oats	Corn

Lab Setup: Each group will prepare four petri dishes to compare how ONE TYPE of seed does at four different salt concentrations. The most concentrated salt solution you will use is about 60%, this is the concentration of average seawater, which is less than the concentration that you used to test the radish seed at the beginning of the unit. When the investigation is over, groups will share results, so that they can compare the different plant seed from their own individual groups. Project Teacher Master FF, Saltwater Germination Setup and go through the steps.

***We will only set up the experiment and leave them in the dark for 2 days. We will then observe them and place them in the light for two days and observe them again. During the time in between, you will be doing flower dissection lab.**

When lab is complete, revisit the Focus Question and answer it.

SALTWATER GERMINATION SETUP

Each group gets four petri dishes and two paper towels.

a. Fold each paper towel into quarters and use the smaller half of a petri dish to trace a circle on the top quarter of one of the folded towels. Cut all four layers of the paper towel at once by cutting on the circle line. Repeat so that you have eight circles.

b. Place two paper towel circles in the larger half of the petri dish. The smaller half of the dish will go on top as a cover.

c. Label both halves of the petri dish with self-stick notes: group name, period, number of spoons of salt, name of seeds.

d. Put 5 mL of the correct salt solution into the half with the paper towels. Spread it around so the entire paper towel circle is wet.

e. Count 40 of your assigned seeds into a plastic cup. Put 10 seeds in each dish. Scatter them across the paper towel. Put the smaller half of the petri dish on top as a cover and make sure the label is secure.

f. Put the dishes in the designated tub. The tub will be placed in a room-temperature dark location or covered with newspaper. This is day 0. On day 2, you will make your first observations and place the dishes in the light.

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Germination and Growth in Different Salinities

The kind of seed we are investigating: _____

Number of seeds "planted" in each dish: _____

1. Record the number of seeds with roots and the number of seeds with shoots in the table below.

	# seeds with roots / # seeds with shoots	0 spoons salt	1 spoon salt	2 spoons salt	4 spoons salt
Day 2					
Day 4 ____					

2. On the final day, make your observations and comments.

0 spoons salt	**1 spoon salt**
2 spoons salt	**4 spoons salt**

LAB: Part 2-Environmental & Genetic Factors

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Comparing Growth

Part 1: Think about the seeds you investigated.

The kind of seed we are investigating: _____

1. In which condition/s did most of your seeds germinate?

   In which condition/s did the fewest of your seeds germinate?

2. In which condition/s do the roots and the shoots of your seeds appear the healthiest? (Compare length of roots and shoots, branching of roots, number of root hairs, greenness.)

3. How does increasing the concentration of salt affect the germination and growth of your seeds?

Part 2: Compare all the seeds at each concentration of salt.

4. Which seeds (oats, wheat, barley, or corn) grew the best at 0 spoons, 1 spoon, 2 spoons, 4 spoons of salt? (Compare number of seeds germinated, healthiest looking.)

	0 spoons salt	1 spoon salt	2 spoons salt	4 spoons salt
Seed type showing most salt tolerance				

5. Which type of food crop is best suited to saline (salty) soil?

6. Answer in your notebook: Is saline soil a suitable environment for germinating and growing food crops? What is your evidence?

GRAINS

Wheat

Barley

Oats

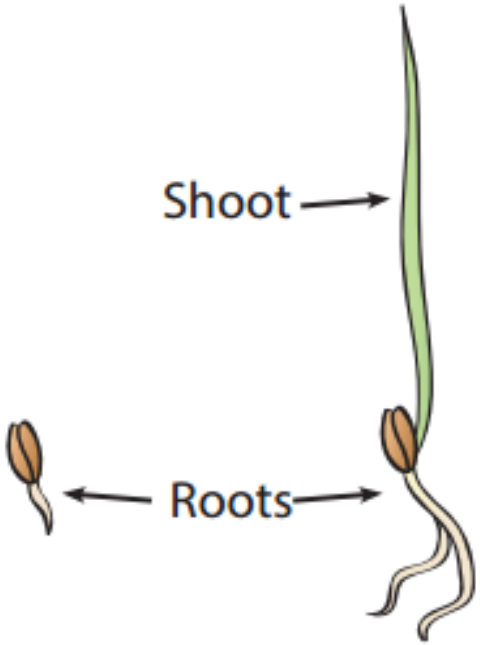
Corn

LAB: Part 2-Environmental & Genetic Factors

LAB: Part 2-Environmental & Genetic Factors

Teacher Master GG

ROOTS AND SHOOTS



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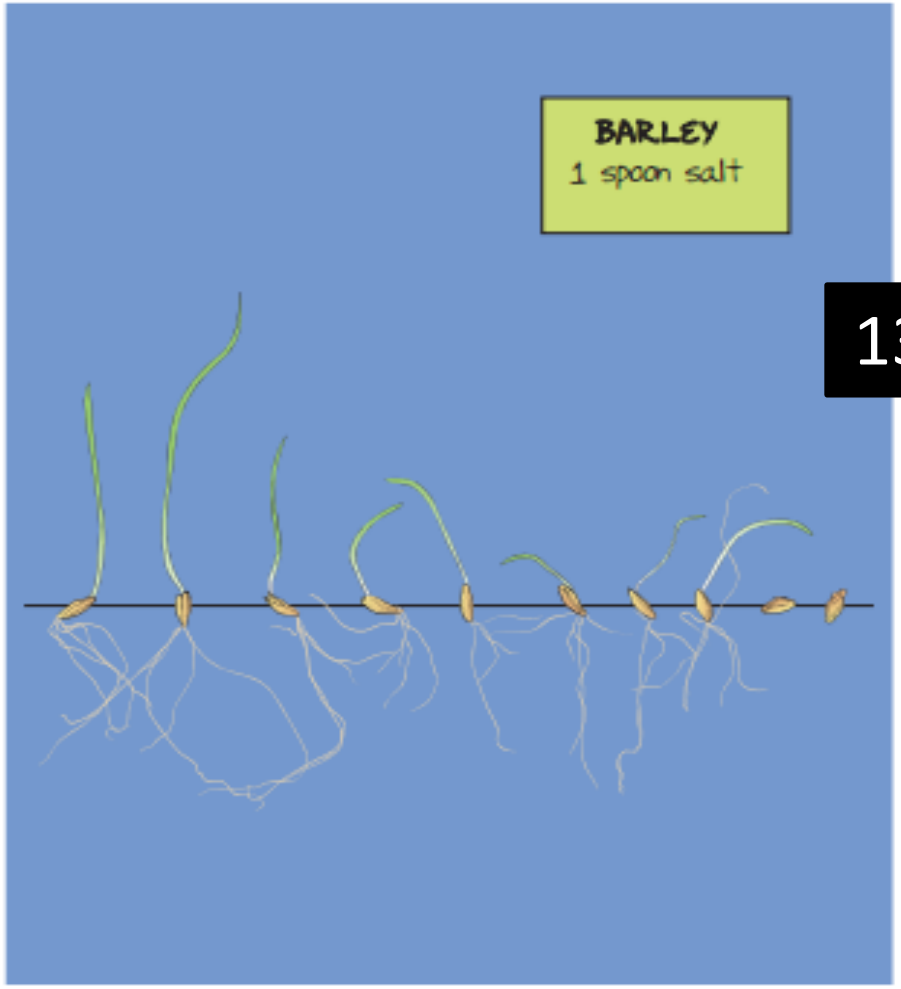
Teacher Master HH

PLANT PROFILE

Follow the model below to set up four plant profiles, one for each petri dish. Place one strip of clear packing tape over the seeds. Place other strips over the shoots and roots if necessary.



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Lab Part 2: Environmental and Genetic Factors Book Pages

Reading Activity: Read hard back book pages 40-42 Breeding Salt-Tolerant Wheat & do the Think Questions.

1. **How does soil salinity (an environmental factor) affect plants?**

2. **How do genetic factors allow some plants to be more salt tolerant?**

3. **How are scientists making durum wheat more salt tolerant?**

4. **Why is this important?**

Reading Activity: Read hard back book pages 43-48: Seeds on the Move & do Think Questions

1. **Why is seed dispersal important for a plant?**

2. **Do all seeds that have been dispersed from a plant come out of dormancy?**

3. **Why or why not?**

4. **What are three (3) ways seeds are dispersed?**

Focus Question: What is the purpose of a flower?

Lab Part 3: Flowering Plant Reproduction

Living things reproduce. Protists and bacteria reproduced asexually, by simply splitting in two. Plants and animals reproduce differently. With a few exceptions, they use sexual reproduction, which means each part gets genetic information from two parents. Flowering plants reproduce sexually, so if it has a flower on it, it has to have undergone sexual reproduction or will do so soon. The food crops we are studying have small flowers on them that are so inconspicuous (small). We will be looking at conspicuous (larger) flowers in order to study sexual reproduction and how it works. These are the flowers we will work with today. They are called: _____ You will work alone or with a partner (depending on how many flowers your teacher has obtained). First you will observe one flower in detail and then you will carefully dissect it to study its structures and design.

Use Lab Sheet #51-Parts of a Flower

Notebook Sheet #52 Flower Dissection A -You will draw carefully and use color in all drawings.

Materials: "Getters" will collect a hand lens for each pair of students. *If you have different types of flowers, assign two flower types to one table to share differences/similarities.

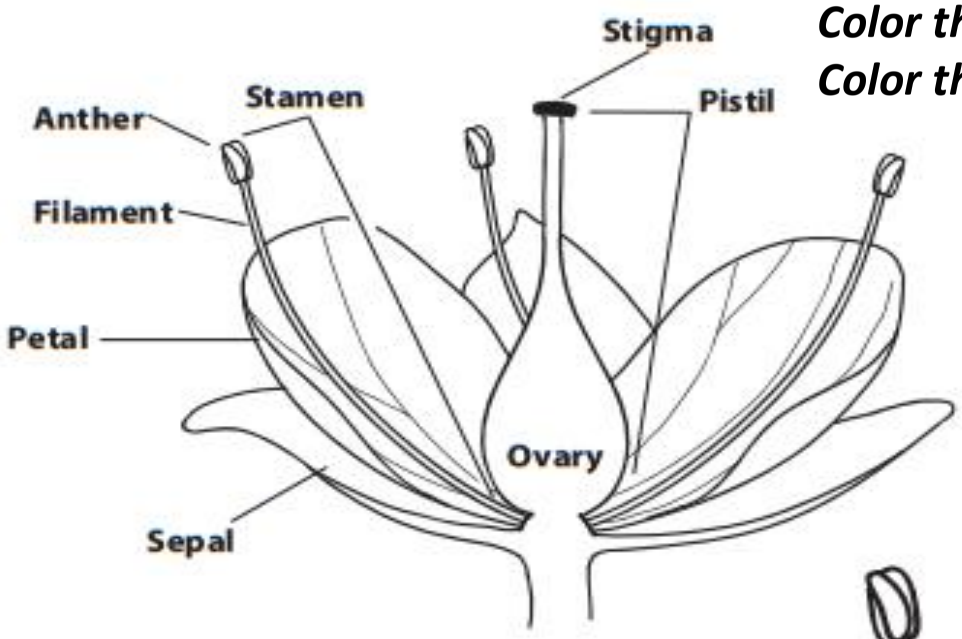
Show video displaying how to Make a Flower Dissection Mount.

Then do Notebook Sheet #53-Flower Dissection B dissect using the paperclip tool assembly as a blade, be careful not to hurt your flower.

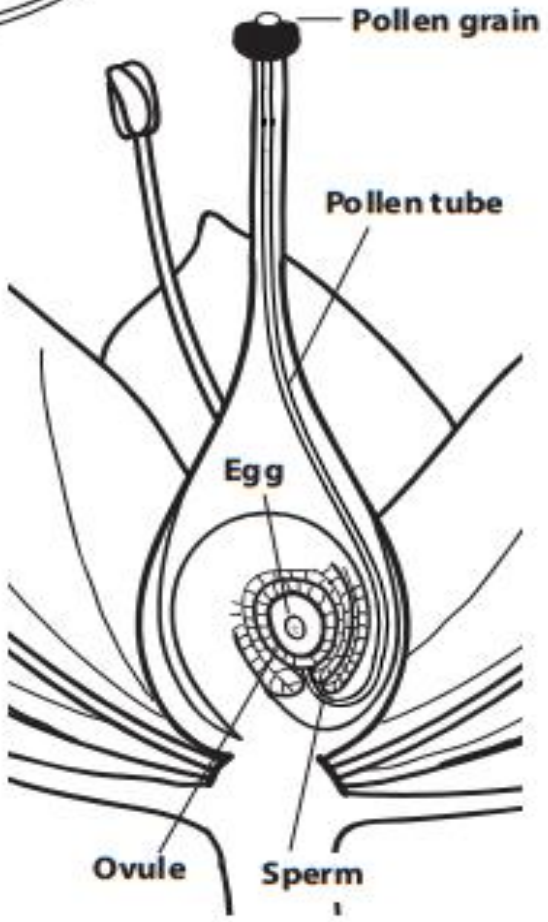
Project the Gladiolus images from Database Flower Collection.

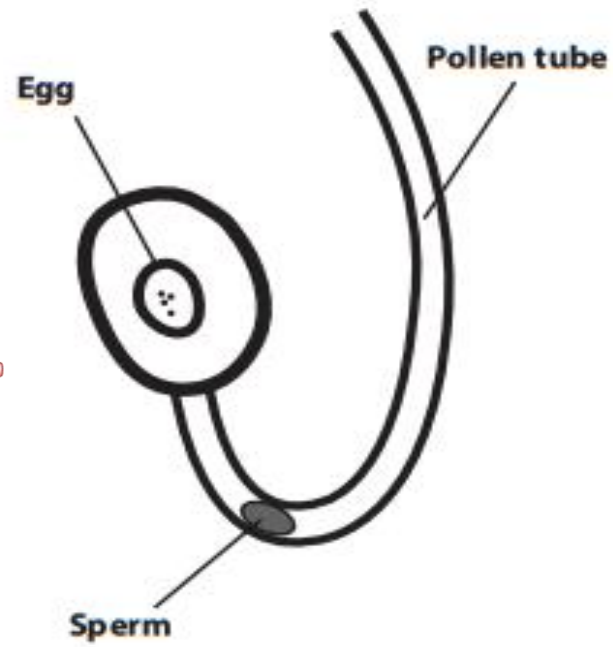
Parts of a Flower

Directions:
Color the male parts blue.
Color the female parts pink.



Simple flower





LAB: Part 3-Flowering Plant Reproduction

Study 20

Flower Dissection A

Dissection of a _____ flower

1. Look into the center of the flower. Draw a picture showing how the stamen and the pistil are arranged. Label your drawing.

2. Observe the end of the stamen closely. Make a close-up drawing showing the structure at the end of the stamen. Label your drawing.

3. Gently push your finger into the center of the flower. Look closely at your finger with a hand lens. Describe what you see.

_____

_____

4. If a microscope is handy, put some of the material on a slide and observe it at 100X and 400X. Draw what you see under high power. Label your drawing.

400X

LAB: Part 3-Flowering Plant Reproduction

Flower Dissection B

5. Remove the sepals. How many are there?_____ **Stick one sepal upside down on the tape near the right end.**

6. Remove the petals. How many are there?_____ **Stick one petal upside down on the tape next to the sepal.**

7. Remove the stamens. How many are there?_____ **Put all the stamens on the tape.**

8. The remaining part is the pistil, which includes the ovary. Use a hand lens to observe the stigma of the pistil. Draw and label it.

9. Ask your teacher to cut open the ovary. Examine the inside of the ovary with your hand lens. Draw and label what you see.

   Place the pistil with the ovary cut side down on the tape next to the stamens.

10. Slide the card out from under the tape. Place the card on top of the mounted flower parts. Press down firmly to stick the card to the tape. Carefully lift up the ends of the tape and fold them to the back of the card to complete the flower mount. **Label all the parts.**

LAB: Part 3-Flowering Plant Reproduction

Due Date: _____

Response Sheet—Investigation 6

One of your good friends was absent the day plant reproduction was discussed in class. She is trying to write a paragraph describing flowering-plant reproduction.

All I know is that baby plants come from seeds—I don't know where seeds come from.

What would you tell your friend that would help her understand how flowering plants reproduce?

LAB: Part 3-Flowering Plant Reproduction

Reading Activity: Read hard back book pages 49-50 The Making of a New Plant and summarize what you read/learned in two sentences below.

Project Database Seed Collection: Gladiolus image and discuss differences/similarities.

PLANT-REPRODUCTION SEQUENCE

	Ovules, which contain the female egg cells, form in the ovary.
	Pollen grains, which contain the male sperm cells, form on the anthers.
	A pollen grain, usually carried by animal or air, lands on the stigma of another flower.
	The pollen grain forms a long tube down the length of the pistil into the ovule.
	A sperm cell travels down the pollen tube.
	The sperm cell fertilizes an egg. The egg and sperm merge to form a single cell with information from the male and female.
	The single cell divides, and each of those cells divides, and so on until the many cells develop into an embryo.
	The parent plant forms a food source for the developing embryo.
	The seed-containing ovary develops into a fruit.
	Fruit is dropped or consumed by an animal, and the seed is released.

LAB: Part 3-Flowering Plant Reproduction

Directions: Using letters A-J, put the sequence (steps) to plant reproduction in order.

Focus Question: What is the purpose of a flower?

Lab Part 3: Nonflowering Plant Reproduction (FOSS) & Asexual Reproduction (not in FOSS)

View the Nonflowering Plants Slideshow. Discuss nonflowering plant reproduction.

What are some plants that don't have flowers?

What are other organisms we have studied that use spores to reproduce?

Show students the ivy and potato that were placed in water several weeks ago. What happened to these plants?

The ivy and potato grew from existing plants, no pollen, no eggs, no seeds. They simply started to grow into a new plant identical to the old plant. This is a form of asexual reproduction called Vegetative Reproduction/Propagation. Both ivy and potato are able to produce flowers (sexual reproduction), but they do not need them to reproduce. The bulbs of daffodils and other similar plants are actually modified stems. Bulbs are another example of asexual reproduction. Focus on slides 7-10. Discuss.
Return to the Living/Nonliving Card Sort and discuss the potato.
Revisit the focus question above. Assign Sheet #55 for homework due date: _____
Seed Hunt homework due date: _____

Name_____ Block ___

Types of Asexual Reproduction

"**L**et's **B**e **T**alkin' **S**ome **R**eal **R**oots!"

L_____

B_____

T_____

S_____

R_____

R_____

Sexual Reproduction
(Draw a flower)

Grow & Develop

Reproduce

Respond to Stimuli

Obtain & Use Resources

Response

Stimuli

Tropism:

Study 20

Responses to the Environment Worksheet

Study 20

1. Stimulus	2. Response	3. Tropism	4. Dormancy
Definition: Pic:	Definition: Pic:	Definition: Pic:	Definition: Pic:
5. Phototropism	**6. Gravitropism**	**7. Hydrotropism**	**8. Thigmotropism**
Definition: Pic:	Definition: Pic:	Definition: Pic:	Definition: Pic:

Review

Study 20

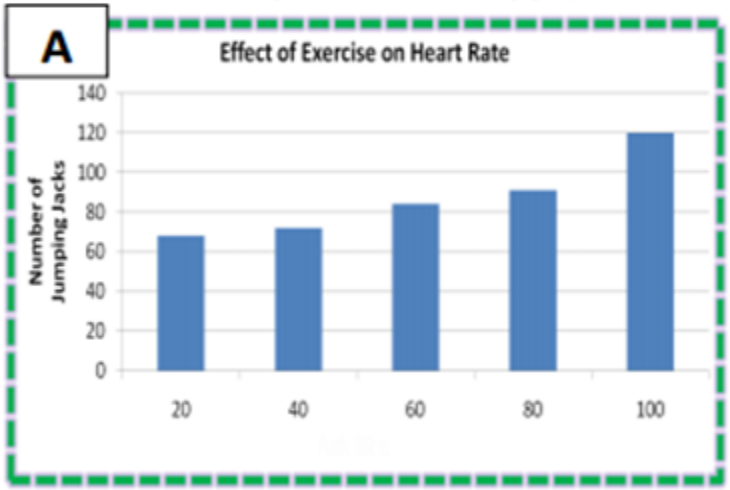
1. _____ tropism
2. _____ phototropism
3. _____ gravitropism/geotropism
4. _____ hydrotropism
5. _____ thigmotropism
6. _____ independent variable
7. _____ dependent variable
8. _____ control group
9. _____ experimental group
10. _____ environmental factors

A. Plants respond to changes in the environment by growing their stems, roots, or leaves toward or away from the stimulus.
B. The factor that can be changed in an experiment, the one that "I CHANGE." *MIX-Manipulated, Independent Variable on the X-Axis*
C. The way a plant's roots grow or move in response to water.
D. The results in an experiment. This is the responding variable. *DRY-Dependent, Responding Variable on the Y-Axis*
E. Conduct investigations to determine ways that air, water, light, minerals, or space affect flowering plants.
F. The way a plant grows or moves in response to light.
G. The group that does not receive the change or experimental variable.
H. The way a plant grows or moves in response to gravity.
I. The group that receives the change or experimental independent variable.
J. The way a plant's leaves or stems grow or move in response to touch. Examples: Venus Flytraps, Mimosa Pudica (Touch-Me-Nots)

Experimental Design Practice: Graphs and Tables

Identify what is wrong with the following graphs.

A



Graph A:

B

Graph B:

Identify the information for the following scenarios.

An experiment was done to see how the depth of the ocean affects the pressure exerted on an object.

Depth of Water Column (Vertical Feet)	Water Pressure (lbs. per sq. in.)
1	0.45
2	0.91
3	1.36
4	1.82
5	2.27
6	2.73

Independent Variable	
Dependent Variable	
Control Group	
Experimental Group	

How does the mass of a bowling ball affect the number of pins that get knocked down?

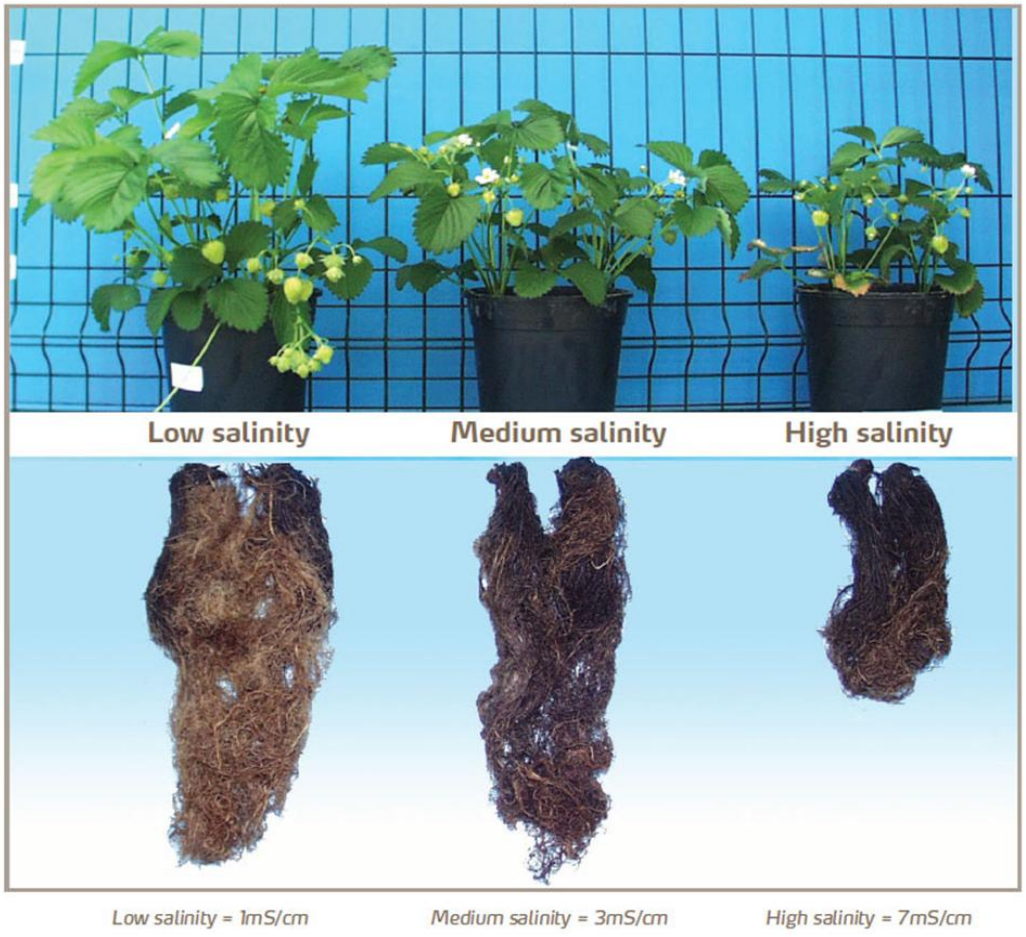
Bowling Ball Mass (kg)	Number of Pins Knocked Down
3	2
4	9
5	1
6	9
7	10
8	3

Independent Variable	
Dependent Variable	
Control Group	
Experimental Group	

Scientific Argument: Claim, Evidence, Reasoning

6.E.2A.2

Salinity and Plant Growth



Find a fact: Which plant's roots grew the best according to this image?
Answer:_____

Using the image, use your scientific argument skills to make a claim, find evidence and reasoning about the concept of salinity's effect on plant growth.

Claim:_____

_____

Evidence:

_____

_____

_____

_____

_____

Reasoning:

_____

_____

_____

_____

_____

How to Solve One-Step Dimensional Analysis Problems

#1 Last year, the teacher's weather station measured 12 yards of rain. Express this amount in cm.

#2 This year, the teacher's weather station measured 22 yards of rain. Express this amount in cm.

Steps to Dimensional Analysis

- Step 1: Write out your problem.
- Step 2: Write all conversion factors as fractions.
- Step 3: Include all units with all numbers.
- Step 4: Arrange conversion factors, so that units cancel diagonally (what goes up, must come down).
- Step 5: Numbers on top are multiplied.
- Step 6: Numbers on bottom are divided.

Conversion

1 yd = 91.44 cm

HOW ENVIRONMENTAL CHANGES AFFECT GROWTH AND DEVELOPMENT OF FLOWERING PLANTS

6.L.5B.4 Plan and conduct controlled scientific investigations to determine how changes in environmental factors (such as air, water, light, minerals, or space) affect the growth and development of a flowering plant.

Essential Knowledge

It is essential for students to plan and carry out the investigation of the effect of environmental factors on plant. Therefore, students should be conducting investigations to determine ways that air, water, light, minerals, or space affect flowering plants. Students should select one factor in order to determine an independent variable. For example, a student could choose to change the amount of water given to a certain species of plant. **For the teacher** - due to limits in the amount of class time available, it is not essential that every student tests each factor. Students can test one factor and share data with others in the class. This should provide all students with an opportunity to make direct observations as well as draw conclusions from the data collected by others.

Extended Knowledge

• The students can review collected data to predict the ideal growth conditions for a variety of plants. Students can compare those predicted conditions with the actual conditions that the plant experiences in its natural environment.

Assessment Guidance

The objective of this indicator is to plan and conduct controlled scientific investigations to determine how changes in environmental factors (such as air, water, light, minerals, or space) affect the growth and development of a flowering plant. Therefore, the primary focus of assessment should be for students to plan and conduct controlled scientific investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form in order to demonstrate the effects of environmental factors on plants. This could include but is not limited to an experiment to determine which key environmental factor (air, water, light, minerals, or space) has the greatest effect on the growth and development of a flowering plant.

In addition to planning and conducting scientific investigations, students should be asked to ask questions, analyze and interpret data, use mathematics and computational thinking, engage in argument from evidence, construct explanations, develop and use models, obtain, evaluate, and communicate information, and construct devices or design solutions.

PLANT RESPONSE TO EXTERNAL STIMULI

6.L.5B.5 Analyze and interpret data to describe how plants respond to external stimuli (including temperature, light, touch, water, and gravity).

Essential Knowledge

It is essential for students to know that plants respond to changes in their environments. These responses (the reply to the change in the environment) vary depending on the specific environmental stimulus (a change in the environment that causes a response or a reaction).

Temperature

- Temperature, along with day length, can be used to manipulate flowering.
- Temperature alone can also influence flowering in some plants.
- For example, many bulb plants (like daffodils) must be exposed to cold temperature to force the bulb to mature.
- Many plants require a daily change of temperature between night and day to ensure photosynthesis and respiration reactions occur at optimal temperatures which will result in maximum plant growth.
- Under certain conditions (frequent temperature changes), when a mature plant or seed becomes or remains *dormant (inactive)*.

Dormancy

- is a period of time when the growth or activity of a plant or seed stops due to changes in temperature or amount of water.
- allows various species to survive in particular environments. It helps to ensure that seeds will germinate when conditions are favorable for survival of the small seedlings.
- *For example*, leaves fall from trees prior to the conditions of winter and the leaf buds do not open again until conditions are favorable in the spring.

Tropisms

- Plants respond to changes in the environment by growing their stems, roots, or leaves toward or away from the stimulus. This response, or behavior, is called a tropism.
- **Examples of plant tropisms include:**
  - **Phototropism** - The way a plant grows or moves in response to light.
  - **Gravitropism** - The way a plant grows or moves in response to gravity; also called geotropism.
  - **Hydrotropism** - The way a plant grows or moves in response to water.
  - **Thigmotropism** - The way a plant grows or moves in response to touch.

Extended Knowledge

- Students can analyze and interpret weather data to see how similar species of plants respond to changes in temperature in different regions of the state and country.
- Students can conduct an experiment where seeds are placed in different directions in order to see how roots and stems respond to gravity.

Assessment Guidance

The objective of this indicator is to analyze and interpret data to describe how plants respond to external stimuli. Therefore, the primary focus of assessment should be for students to analyze and interpret data from informational texts, observations, measurements, or investigations to construct scientific explanations describing how plants respond to changes in their environments. This could include but is not limited to students observing growing plants and describing how they have grown in response to light, touch, water, and gravity. Students may also be able to gather evidence that would support the hypothesis that plants grow in response to light, tough, water, and gravity (see 6.L.5B.4).

In addition to analyze and interpret data, students should be asked to ask questions; plan and carry out investigations; use mathematics and computational thinking; engage in argument from evidence; construct explanations; develop and use models; obtain, evaluate, and communicate information; and construct devices or define solutions.