

# Cluster 3

## *Racey Soys*

### Lessons:

1. Examining the Bean
2. Germinating Soybean Seeds
3. Racey Soys!
4. What Do Plants Need To Survive?
5. Soybean Plant Parts
6. Assessments (p. 37-41)

### Guiding Question:

How do soybeans grow?

### Michigan Benchmarks for Science

Elementary	Middle School
I.1.E.1	I.1.MS.1
I.1.E.4	I.1.MS.3
I.1.E.6	III.2.MS.2
III.2.E.3	III.5.MS.6
III.2.E.4	
III.2.E.5	
III.5.E.2	
III.5.E.3	

# Examining the Bean

## Activity:

Examining physical characteristics of soybean seeds.

## Purpose:

- Observe physical characteristics of seeds.
- Record observations.
- Make comparisons.

## Vocabulary:

seed  
coat  
embryo  
dormant

## Background:

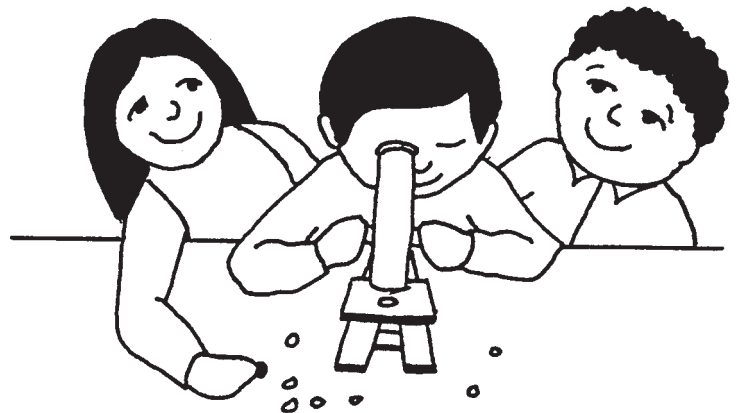
In every seed lives an immature plant or embryo, complete with leaf, stem, and root parts. The seed coat protects the embryo, while the fleshy seed (cotyledon) stores food for germination. Seeds remain inactive until conditions are right (appropriate temperature, air, moisture) for them to germinate.

## Materials:

- hand magnifiers
- soybeans
- lab sheet, *Examining the Bean* (p. 25)

## Time:

20 minutes

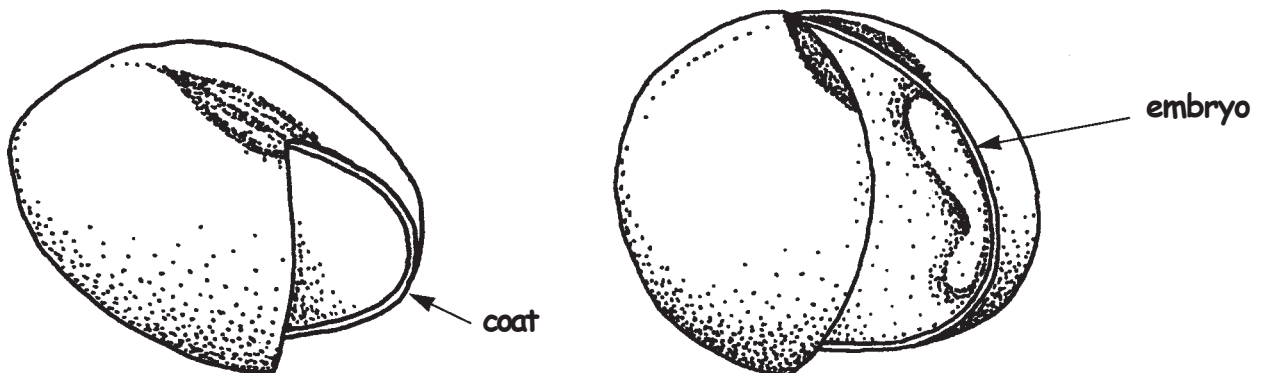


## Procedure:

1. Pass out one soybean to each student. Ask: What part of a plant is the soybean? (the seed)
2. Ask: What is the purpose of seeds in the life of plants? (They serve as a vehicle for passing on new generations of plants)
3. What are the three basic parts of a seed? (seed coat, embryo, seed)
4. How are soybeans different from other seeds you have observed? How are they similar?
5. Pass out the observation *worksheet* (p. 25). Have the students complete the Day 1 section. They can use the hand magnifiers for observations.
6. Fill a cup with water and place the seeds in it. Soak the seeds overnight.
7. Gather the observation worksheets and the cup of soybean seeds.
8. Have the students complete the Day 2 section of the worksheet.
9. Ask: What changes occurred in the seeds overnight? (They swelled by taking in water)
10. Have the students compare the two charts. Share what they discovered.
11. Next, have the students carefully pry their seed open. They should observe the different seed parts.
12. Have students write an explanation of how seeds are made and their function.

## Extended Activities:

1. Observe other seeds. Compare their physical characteristics.



Name: \_\_\_\_\_

# Examining the Bean

## Day 1 Observations

Define the following terms:

seed \_\_\_\_\_

seed coat \_\_\_\_\_

dormant \_\_\_\_\_

Draw a picture of your soybean in the space below. Label all visible parts of the seed.

## Day 2 Observations

Define the following terms:

leaf \_\_\_\_\_

embryo \_\_\_\_\_

young \_\_\_\_\_

parent \_\_\_\_\_

root \_\_\_\_\_

Draw a picture of your soybean in the space below. Label all visible parts of the seed.

On the back of this sheet, answer these two questions: What happened overnight that allowed you to see more of the bean? If seeds were not watered enough, what would probably happen?



# Germinating Soybean Seeds

## Activity:

Germinating soybean seeds.

## Vocabulary:

germination

## Purpose:

- Germinate seeds.
- Observe changes in the seeds.
- Chart observations.

## Background:

In order for plants to survive periods of environmental extremes (fire, cold, droughts, etc.), flowers produce seeds containing dormant immature plants. Once these seeds are exposed to air, water and the proper temperature, they germinate. The embryo begins to divide and the seed coat breaks open. Roots emerge first, followed by the shoot, containing the stem and leaves.

## Materials:

- soybean seeds
- resealable bags
- paper towels

## Time:

20 minutes



## Procedure:

1. Soak the soybean seeds for 8 hours or overnight in warm water (60-70° F).
2. The next day, give each student a moist paper towel and one bean. Fold the paper accordion-style. Put the bean in the moist paper towel and place it in the plastic bag. Keep the paper towel moist. (Note: some seeds may not germinate. This is normal.) Don't seal bag.
3. Observe the beans for a week. Students can record changes on a growth data sheet by folding the long strip of paper like an accordion.
4. Draw on one section at a time as the seed grows. When complete, unfold to view the germination sequences.

## Example of the growth data sheet.

Day 3: No change in bean
Day 2: Wrapped seeds in towel and placed in resealable bag
Day 1: Soaked beans for 12 hours in water

# Racey Soys!

## Activity:

Growing soybeans.

## Purpose:

- Plant seeds
- Observe growth
- Record observations

## Vocabulary:

roots  
stems  
seeds  
fruit  
leaves

## Background:

Over 3,000 years ago, soybeans were cultivated by the Chinese. At that time the bean had only small seeds and grew flat on the ground. Farmers selected seeds of plants with larger fruits (the seed) and those which grew more upright. Over a period of years, the once wild soybean was domesticated into an bushy plant with easy to see seeds.

Soybeans are an annual plant, completing their life cycle within one year. They are planted in the spring and harvested in the fall. When they are harvested, the leaves and stalks are brown. The bean is the "gold" of the plant and is presently the major plant part sought by farmers.

## Materials:

- soybean seeds
- peat pellets
- metric rulers
- lab sheet, *Racey Beans* (p. 30)
- graph sheet (p. 31)
- cups

## Time:

15-20 minutes



## Procedure:

1. Give each group of two students a peat pellet.
2. Soak the peat pellets in a cup with water until they swell.
3. Using a pencil, plant the bean seed about 1/4" in each peat pot.
4. Student pairs should record their observations on the *Racey Beans* lab sheet (p. 30).
5. Use the lab sheet to create a chart of plant growth.
6. Make graphs of the plant growth (p. 31).
7. Save the plants for upcoming activities.

\* **NOTE:** Plant 10 extra beans at this time in case some plants do not grow well, or for use with Lesson 4 - p. 33, #4.

## Extended Activities:

1. Have students plant soybeans in different soil types. Observe what soil is best for maximum growth.
2. Alter one soybean plant with a fertilizer. Observe what happens to the plant.

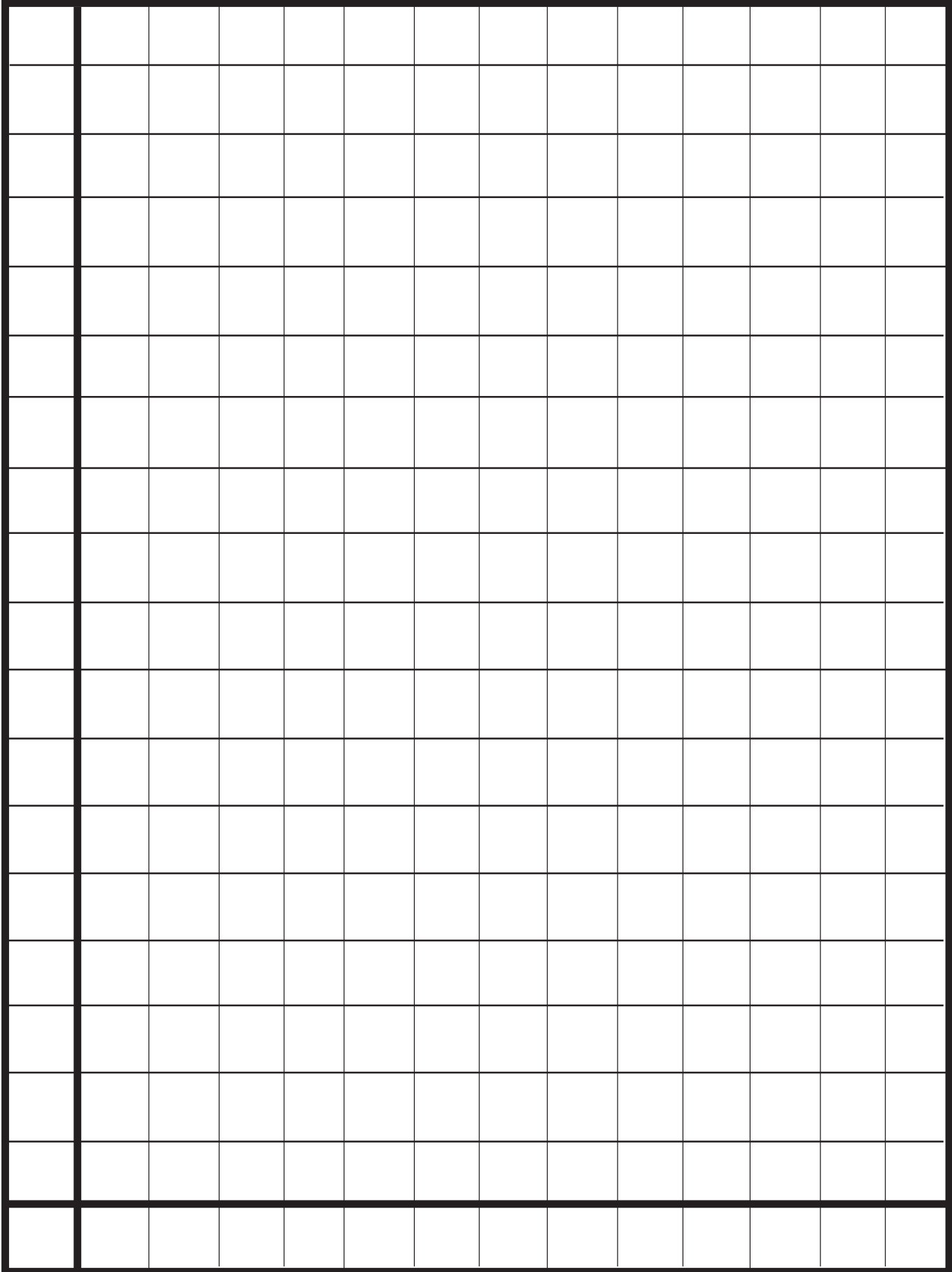
Name: \_\_\_\_\_

# Racey Beans

Date	Height cm.	Drawing of Plant

Graph the height of your plant for each day. Name \_\_\_\_\_

N  
U  
M  
B  
E  
R  
  
o  
f  
  
D  
A  
Y  
S



NUMBER of CM TALL



# What Do Plants Need To Survive?

## Activity:

Experimenting to determine the requirements needed for plants to survive.

## Purpose:

- Determine what plants need to survive.
- Experiment with different variables.
- Chart and graph observations.

## Vocabulary:

food  
air  
water  
minerals  
space  
sunlight  
habitat

## Background:

Plants use materials (water, sunlight, minerals, food, and air) to grow and reproduce. Plants capture the sun's energy in their leaves and stems and use it to produce energy-rich molecules that we call food. To do this, water and minerals are pulled into the roots. This happens because water is constantly being lost by evaporation occurring at the stomata. Stomata are located on the underside of leaves. Air (oxygen and carbon dioxide) enters and exits the plant through the stomata. Carbon dioxide combines with water and, in the presence of sunlight, is converted into food. This cycle continues and "food" is produced and stored. Much of the energy produced by photosynthesis is stored in the bean (seed).

## Materials:

- bean plants
- lab sheet, *Life Requirements* (developed through #2 procedure on p. 33)
- lab sheet, *Racey Beans* (p. 30)

## Time:

15-20 minutes set-up  
5-10 daily observations

## Procedure:

1. Have the students keep their soybean plants from the *Racey Beans* lesson.
2. Discuss what elements were necessary for the plants to grow and develop. Make a class list of *Life Requirements*.
3. Next, have the groups get their soybean plants. Combine two groups to make teams of four. They should decide what life requirement they want to test for. For example, students might observe what happens to the plant if it is removed from the soil, (all the other requirements-sunlight, air and water remain constant). Basically, students will construct an experiment to limit one of the life requirements (food, air, water, minerals, space, sunlight, habitat).
4. Groups should leave one of their plants for the control and alter the other.
5. Record observations for two weeks. Use the same lab sheet as was used for *Racey Beans* (p. 30).
6. Discuss what happened to the plants. Compare the control with the variable in each group's experiment.
7. Save control plant!

## Extended Activities:

1. Grow soybean seeds and expose them to different variables-sugar, vinegar, fertilizer, lemon juice, baking soda. Students can make predictions about what might happen to their plant.
2. Discuss the life requirements for other plants and animals. How are they similar and different? Make a *Venn diagram* (p. 8) showing these factors.

# Soybean Plant Parts

## Activity:

Labeling and discussing the functions of soybean plant parts.

## Vocabulary:

See "Background"

## Purpose:

Understand the functions of selected seed plant parts.

## Background:

Just as humans have specific body parts that carry out life processes, so do plants. The six major external parts of flowering plants are:

**roots** - transport water and minerals, store food, and anchor the plant in the ground

**stems** - the skeleton for the plant containing the inner vascular highway for water, mineral, and food transport

**leaves** - major site of photosynthesis where oxygen is released and carbon dioxide is absorbed through the stomata

**flower** - the seed producing structure of a plant

**seed** - a unique, immature plant that grows and develops when placed in an environment containing air, water, and warmth

**fruit** - mature flower which swells with developing seeds. Fruits normally contain stored energy that helps feed seeds during germination

## Materials:

- lab sheet, *Parts of a Soybean Plant* (p. 36)
- control soybean plant saved from page 33
- *Racey Soys! 1* (p. 37-38) and *Racey Soys! 2* (p. 39-40)

## Time:

15-20 minutes

## Procedure:

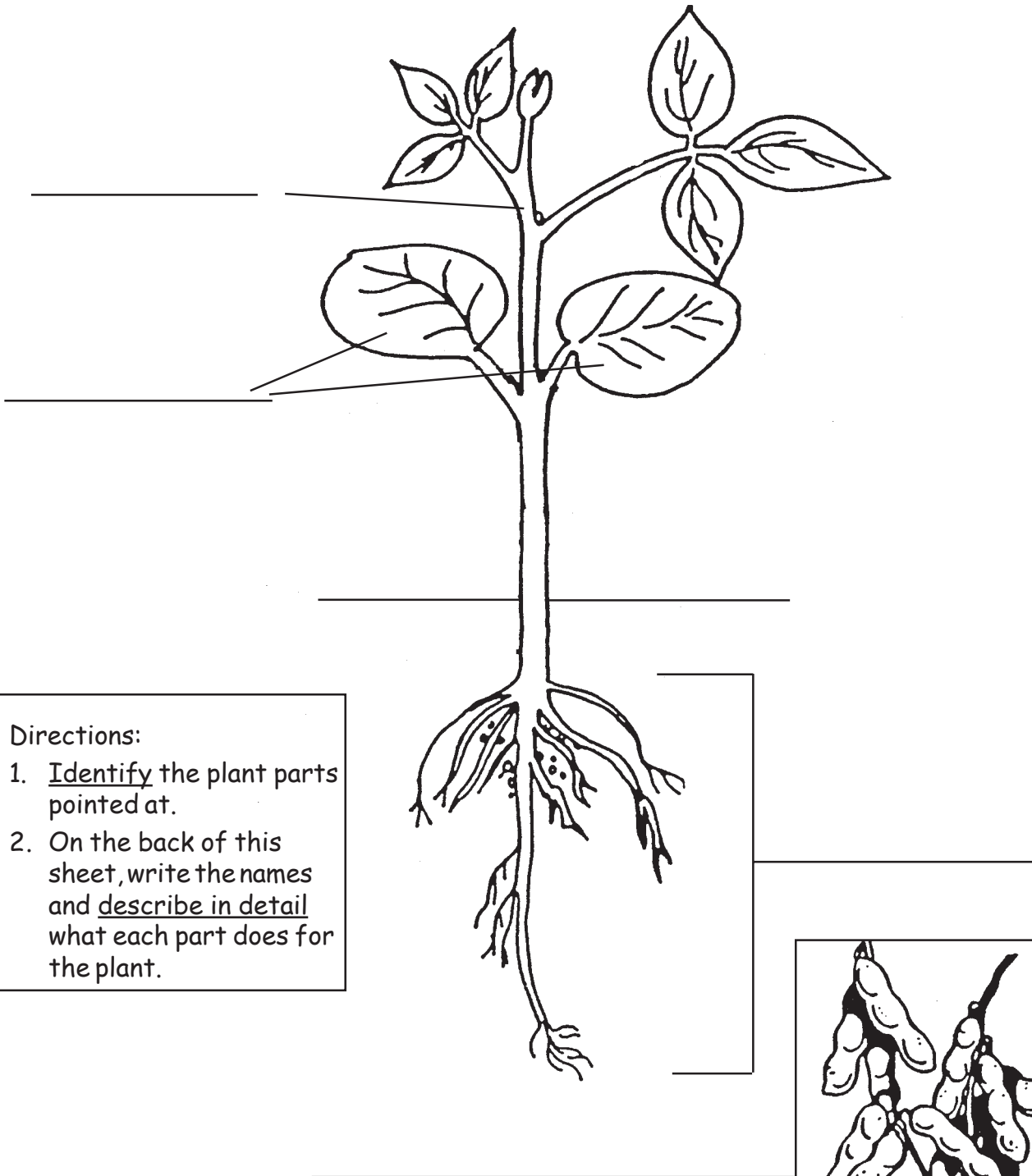
1. Teams of students should gather their Racey Beans (control plant). Then, observe the plant and list all the parts they can see.
2. Next, ask them to think about some parts that they can't see (or ones that haven't developed yet). Add these to their list.
3. Have the groups share their ideas. Combine the ideas into a class list called "Plant Parts."
4. Groups then can discuss the functions of the parts on their list.
5. Give each team one lab sheet, *Parts of a Soybean Plant* (p. 36). They should label the parts and explain the basic functions of each as well as the relationships between the structures.
6. Discuss the life cycle of flowering plants. 1) Seed grows. 2) Flowering plants grow and develop flowers that will mature into fruit, if fertilized. 3) Fruit grows which contains seeds, new immature dormant plants. The soybean fruit is the pod.
7. Have students work through *Racey Soys! 1* (p. 37-38) and *Racey Soys! 2* (p. 39-40).

## Extended Activities:

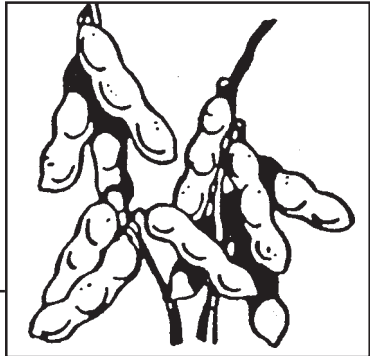
1. Observe parts of other plants. Compare and classify the similarities and differences. Discuss the functions of the plant parts. Are the "roles" the same for different plants.
2. Create an "Art Soybean Plant." Give the students a variety of art supplies: construction paper, tissue paper, pipe cleaners, scissors, glue, and crayons. On a piece of construction paper, have students design a soybean plant. Their plant should show at least three of the six different plant parts with labels describing the functions of the three parts.

Name \_\_\_\_\_

# Parts of a Soybean Plant



Directions:  
1. Identify the plant parts pointed at.  
2. On the back of this sheet, write the names and describe in detail what each part does for the plant.



From Nebraska's Ag in the Classroom Program.

## Racey Soys! 1

Read the paragraph below and answer the questions related to it.

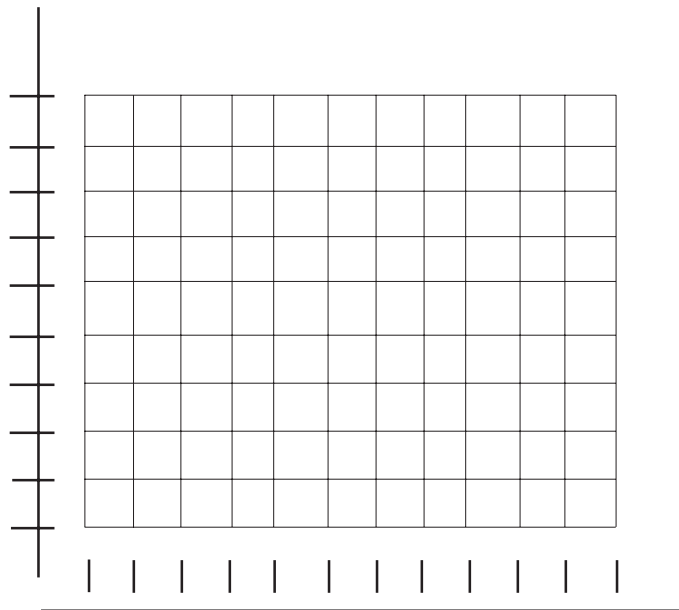
Susan and Jose are planning to grow a garden. They live in the city with many tall buildings. There are buildings all around their garden plot. They plan to grow many different types of plants. They have been learning about how soybeans are used for many different kinds of food. They want to save a small part of their garden for soybeans. They plant their garden and observe the growth every day.

1. Susan and Jose observe their garden growing. Describe the life cycle their flowering plants go through.
  - a. seed----flower----fruit----seed
  - b. seed----fruit----flower----seed
  - c. fruit----flower----seed----fruit
  - d. flower----seed----fruit----flower
  
2. Their garden has many plants growing in it. What plant part collects the most sunlight to make food?
  - a. the root
  - b. the flower
  - c. the stem
  - d. the leaf
  
3. Before planting their garden, Susan and Jose talked about the different places they could plant their garden. Their first choice was between two tall buildings. They decided that this place was not the best because:
  - a. the buildings would block people from seeing it
  - b. the buildings might block out the sunlight
  - c. the buildings might make the soil dirty
  - d. the buildings might keep the air away from the plants

4. Where does the seed develop in flowering plants?
  - a. in the stem
  - b. in the flower
  - c. in the leaf
  - d. in the fruit
  
5. What plant part uses sunlight to make its own food?
  - a. the root
  - b. the leaf
  - c. the flower
  - d. the fruit
  
6. Susan and Jose kept a journal of their daily observations. Each day they measured the height of the same soybean plant. They made measurements for 30 days. Here is what their journal looked like.

Days	Height
1	0
5	3 cm.
10	6 cm.
15	12 cm.
20	15 cm.
25	19 cm.
30	24 cm.

Use their journal entries to make a bar graph of the results. Use the blank graph below to chart the results.



## Racey Soys! 2

Look at the seed package below. Answer the questions that relate to it.

### Soybean Seeds

*Days until Harvest: 120 days*

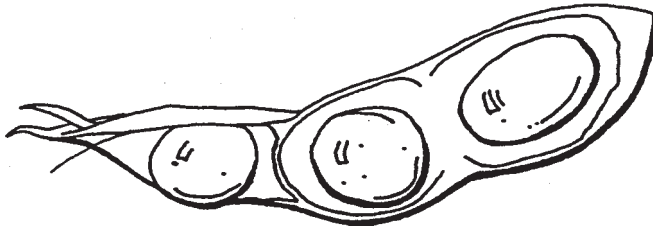
*Days for Germination: 3-5 days at 60 degrees*

*Amount of Sunlight: direct sun, as much as possible*

*Amount of Water: 1.5 gallons/pound of soybeans*

*Spacing: plant in 7 inch wide rows with 3-4 beans/foot of row*

*Uses: excellent for salad dressings, vegetable oils, soaps and detergents.*



1. What type of sunlight is needed for growth?
  - a. direct
  - b. shade
  - c. partly
  - d. does not matter
  
2. Soybeans can be used in many different products. Describe at least three uses for soybeans.

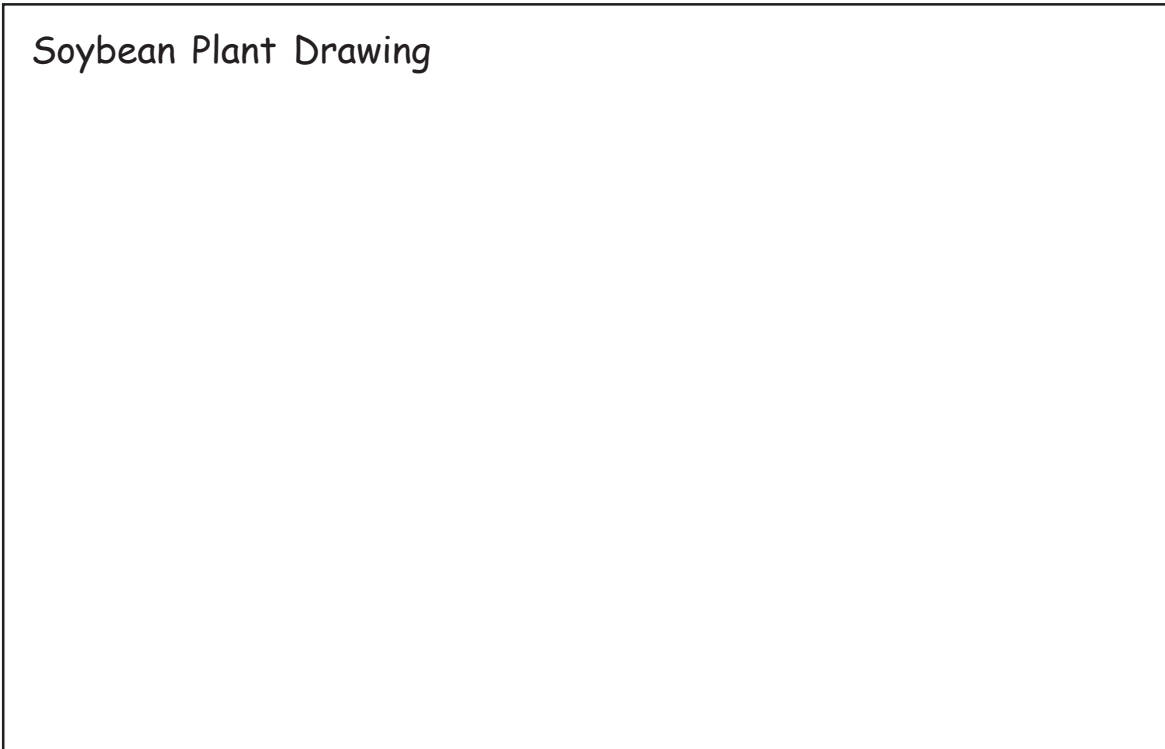
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3. Normally soybeans are fully developed in how many days?
  - a. 3-5 days at 60 degrees
  - b. 120 days
  - c. 110 days
  - d. 10-15 days at 45 degrees
  
4. Besides sunlight, what other growth requirements are explained on the seed package?
  - a. fertilizer and water
  - b. germination and water
  - c. space and fertilizer
  - d. water and air
  
5. You have used the seeds in this package to grow soybean plants. Draw and label at least 3 parts of a soybean plant. Explain what each part does.

Soybean Plant Drawing



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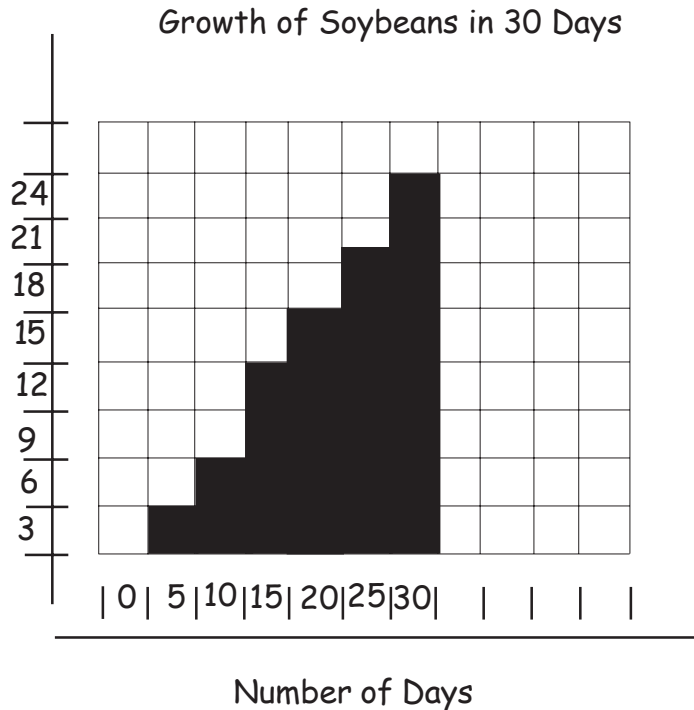
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# Answer Sheet for Racey Soys! 1 and 2

## Racey Soys 1

1. a
2. d
3. b
4. d
5. b
6. Answers to this question will vary depending on how a student sets up their graph. But it should look reasonably close to this.



## Racey Soys 2

1. a
2. salad dressings, vegetable oils, soaps, detergents, etc. (There may be other acceptable answers too!)
3. 120 days harvest
4. b
5. See scoring below

### Score

- 3: drawing with 3 parts accurately labeled and their functions explained
- 2: drawing with 2 parts accurately labeled and their functions explained
- 1: drawing with 1 part accurately labeled and its function explained
- 0: no attempt