

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

Date: \_\_\_\_\_

## What's the Matter?

### Part 1: How do you think plants grow?

1. After watching these video clips and drawing upon your own experience, where do you think plants get their material to grow? Explain the reasoning behind your thinking.

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2. From our discussion, what are some things we think plants need to grow?

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### Part 2: Let's conduct an experiment!

**Class Question:** \_\_\_\_\_

As a class, we will investigate 4 different growing conditions:  
(Circle the option to which your group has been assigned.)

**Light & Water**

**Light & No Water**

**Dark & Water**

**Dark & No Water**

**Controls (variables you will hold constant):**

|             |   |       |              |   |       |
|-------------|---|-------|--------------|---|-------|
| Soil amount | / | _____ | Light amount | / | _____ |
| Soil type   | / | _____ | Water amount | / | _____ |

3. We will grow our plants over the course of 3 weeks. Predict which growing conditions will allow the plant to grow the most during this time. Make sure to explain your prediction using the factors you think affect plant growth.

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### Part 3: Data Collection

Use the scales to measure the mass of each part of the initial experimental set-up. Measure the mass to the nearest hundredth of a gram (g) and the plant height to the nearest centimeter (cm). Final measurements of the experimental set-up will be taken on Day 21.



#### Initial Measurements

| Day 0                        | Radish 1 | Radish 2 | Pinto Bean 1 | Pinto Bean 2 |
|------------------------------|----------|----------|--------------|--------------|
| Mass of seeds                |          |          |              |              |
| Mass of cups, towel, and bag |          |          |              |              |
| Mass of soil                 |          |          |              |              |
| Mass of water                |          |          |              |              |
| Mass of entire set-up        |          |          |              |              |

#### Final Measurements (Take mass of entire set-up FIRST, then work down the list.)

| Day 21                                         | Radish 1 | Radish 2 | Pinto Bean 1 | Pinto Bean 2 |
|------------------------------------------------|----------|----------|--------------|--------------|
| Mass of entire set-up                          |          |          |              |              |
| Mass of plants                                 |          |          |              |              |
| Mass of cups, towel, and bag (same as initial) |          |          |              |              |

#### Final Calculations

|                                                                                                                    |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| Mass of soil and water<br><br>To calculate:<br>Mass of set-up —<br>Mass of plants —<br>Mass of cups, towel and bag |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------|--|--|--|--|

# Data Collection: Experiment 1 Radishes

Our group's growing conditions: \_\_\_\_\_

| Time                 | My Group's<br>Radish 1                            | My Group's<br>Radish 2                            | Partner Group's<br>Radish 1 |               | Partner Group's<br>Radish 2 |               | Averages<br>(Measurements only) |               |
|----------------------|---------------------------------------------------|---------------------------------------------------|-----------------------------|---------------|-----------------------------|---------------|---------------------------------|---------------|
|                      |                                                   |                                                   | Mass of Set-up:             | Plant Height: | Mass of Set-up:             | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 0</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 3</b><br>(M)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 5</b><br>(W)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 7</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 10</b><br>(M) | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

## Data Collection continued: Experiment 1 Radishes

| Time                        | My Group's<br>Radish 1                            | My Group's<br>Radish 2                            | Partner Group's<br>Radish 1 |               | Partner Group's<br>Radish 2 |               | Averages<br>(Measurements only) |               |
|-----------------------------|---------------------------------------------------|---------------------------------------------------|-----------------------------|---------------|-----------------------------|---------------|---------------------------------|---------------|
|                             |                                                   |                                                   | Mass of Set-up:             | Plant Height: | Mass of Set-up:             | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 12</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 14</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 17</b><br><b>(M)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 19</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 21</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

# Data Collection: Experiment 1 Pinto Beans

Our group's growing conditions: \_\_\_\_\_

| Time                 | My Group's<br>Pinto Bean 1                        | My Group's<br>Pinto Bean 2                        | Partner Group's<br>Pinto Bean 1 |               | Partner Group's<br>Pinto Bean 2 |               | Averages<br>(Measurements only) |               |
|----------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------|---------------|---------------------------------|---------------|---------------------------------|---------------|
|                      |                                                   |                                                   | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 0</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 3</b><br>(M)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 5</b><br>(W)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 7</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 10</b><br>(M) | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

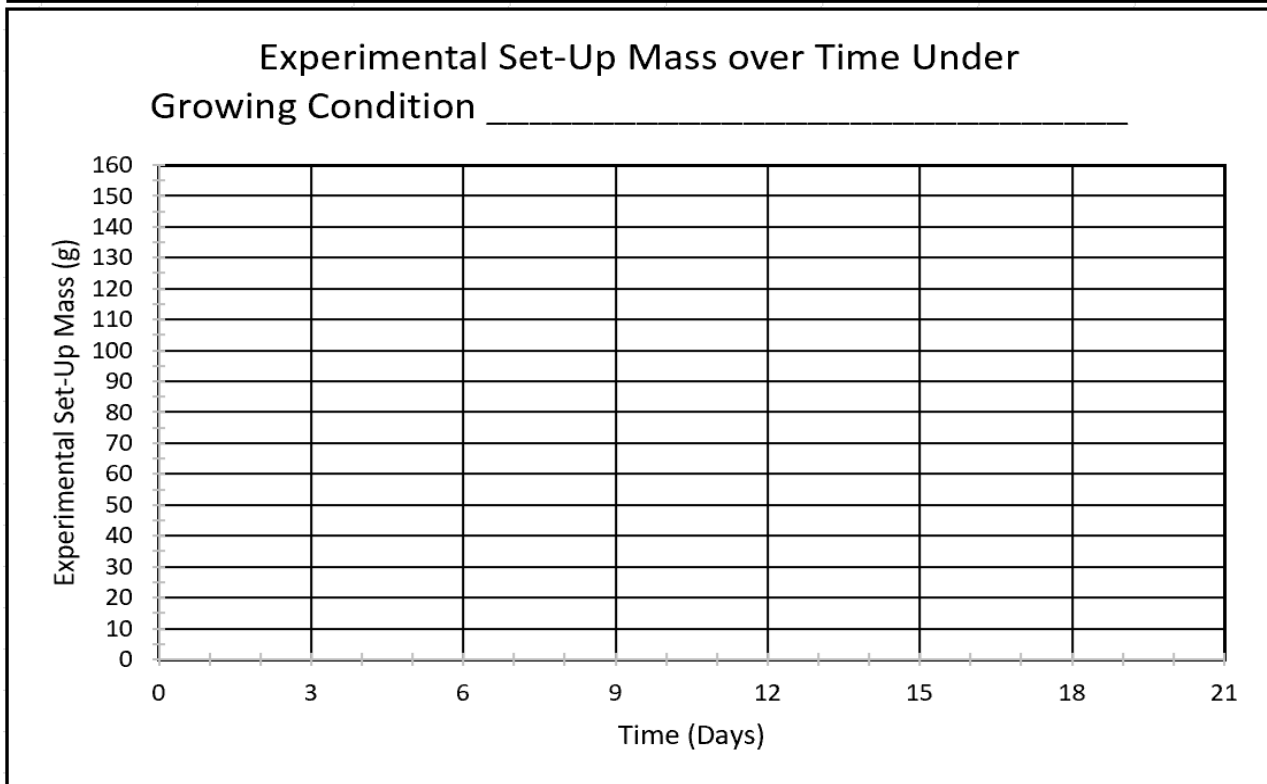
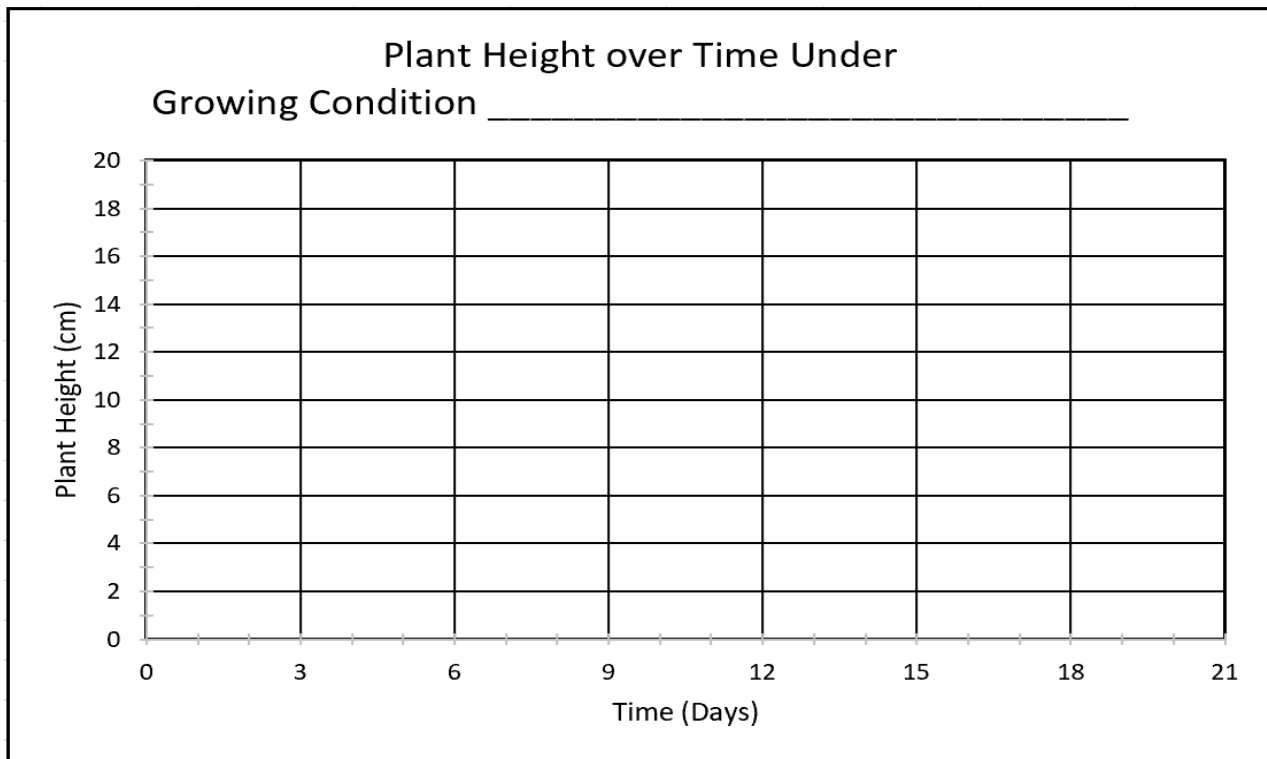
## Data Collection continued: Experiment 1 Pinto Beans

| Time                        | My Group's<br>Pinto Bean 1                        | My Group's<br>Pinto Bean 2                        | Partner Group's<br>Pinto Bean 1 |               | Partner Group's<br>Pinto Bean 2 |               | Averages<br>(Measurements only) |               |
|-----------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------|---------------|---------------------------------|---------------|---------------------------------|---------------|
|                             |                                                   |                                                   | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 12</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 14</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 17</b><br><b>(M)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 19</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 21</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

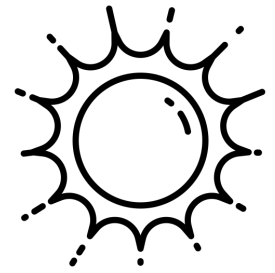
## Part 4: Data Analysis

Use the graph below to plot your data. Graph only the average values for your and your partner group's plants. Use a **red** pencil to plot the points for the radishes and a **black or gray** pencil to plot the points for the pinto beans. Fill in your group's growing condition in the blank in the graph title.



Once you've graphed your data here, go to the Class Data file in Google sheets. You and your partner groups will input your data to create two graphs. One partner group will create the plant height graph and the other partner group will create the experimental set-up mass graph.

## Part 5: Conclusions



4. How did the plant height for both plants change over time in the **light & water** experiment?

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5. How did the plant height for both plants change over time in the **dark & water** experiment?

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6. From this we can conclude \_\_\_\_\_

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7. How did the plant height for both plants change over time in the **light & no water** experiment?

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8. How did the plant height for both plants change over time in the **dark & no water** experiment?

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9. From this we can conclude \_\_\_\_\_

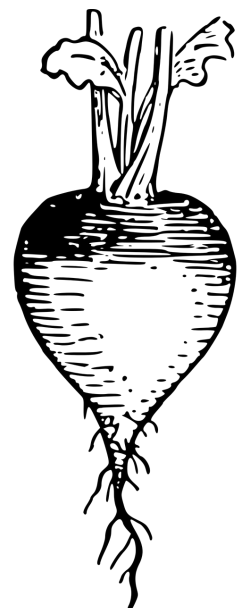
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10. In the cups that had water, what did you observe about the water level over the course of 21 days?

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11. Did the mass of the experimental set-up change over time for all experiments?

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12. The Law of Conservation of Matter says that \_\_\_\_\_ cannot be  
\_\_\_\_\_ nor \_\_\_\_\_.

13. From our experiment, we know that in some cases plants grew. Does this mean new matter was created through the plant?                      YES                      NO  
(Circle one)

14. From our experiment, where do you think the plant got its material to grow, and why?

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## Part 6: Further Experimentation

**Class Question:** \_\_\_\_\_

As a class, we will investigate 4 different growing conditions over the next 3 weeks:  
(Circle the option to which your group has been assigned.)

**Light & Air**

**Dark & Air**

**Light & Little to No Air**

**Dark & Little to No Air**

**Controls (variables you will hold constant):**

|                          |                            |
|--------------------------|----------------------------|
| Soil amount _____/_____  | Light amount _____/_____   |
| Water amount _____/_____ | Container type _____/_____ |

15. Make a prediction about plant growth for each of these growing conditions. Which growing condition do you think will allow the plant to grow the tallest? Will any of these growing conditions not allow a plant to grow?

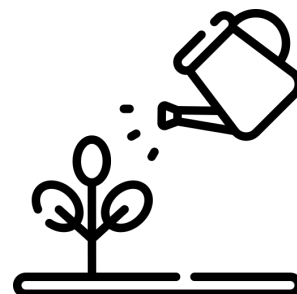
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## Part 7: Data Collection 2

Use the scales to measure the mass of each part of the initial experimental set-up. Measure the mass to the nearest hundredth of a gram (g) and the plant height to the nearest centimeter (cm). Final measurements of the experimental set-up will be taken on Day 21.



### Initial Measurements

| Day 0                 | Radish 1 | Radish 2 | Pinto Bean 1 | Pinto Bean 2 |
|-----------------------|----------|----------|--------------|--------------|
| Mass of seeds         |          |          |              |              |
| Mass of towel and bag |          |          |              |              |
| Mass of water         |          |          |              |              |
| Mass of entire set-up |          |          |              |              |

**Final Measurements (Take mass of entire set-up FIRST, then work down the list.)**

| Day 21                                                                   | Radish 1 | Radish 2 | Pinto Bean 1 | Pinto Bean 2 |
|--------------------------------------------------------------------------|----------|----------|--------------|--------------|
| Mass of entire set-up                                                    |          |          |              |              |
| Mass of plants<br>To measure:<br>Remove plants from towel using tweezers |          |          |              |              |
| Mass of towel and bag<br>(same as initial)                               |          |          |              |              |

### Final Calculations

|                                                                                                 |  |  |  |  |
|-------------------------------------------------------------------------------------------------|--|--|--|--|
| Mass of water<br>To calculate:<br>Mass of set-up —<br>Mass of plants —<br>Mass of towel and bag |  |  |  |  |
|-------------------------------------------------------------------------------------------------|--|--|--|--|

# Data Collection: Experiment 2 Radishes

Our group's growing conditions: \_\_\_\_\_

| Time                 | My Group's<br>Radish 1                            | My Group's<br>Radish 2                            | Partner Group's<br>Radish 1 |               | Partner Group's<br>Radish 2 |               | Averages<br>(Measurements only) |               |
|----------------------|---------------------------------------------------|---------------------------------------------------|-----------------------------|---------------|-----------------------------|---------------|---------------------------------|---------------|
|                      |                                                   |                                                   | Mass of Set-up:             | Plant Height: | Mass of Set-up:             | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 0</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 3</b><br>(M)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 5</b><br>(W)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 7</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 10</b><br>(M) | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

## Data Collection continued: Experiment 2 Radishes

| Time                        | My Group's<br>Radish 1                            | My Group's<br>Radish 2                            | Partner Group's<br>Radish 1 |               | Partner Group's<br>Radish 2 |               | Averages<br>(Measurements only) |               |
|-----------------------------|---------------------------------------------------|---------------------------------------------------|-----------------------------|---------------|-----------------------------|---------------|---------------------------------|---------------|
|                             |                                                   |                                                   | Mass of Set-up:             | Plant Height: | Mass of Set-up:             | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 12</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 14</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 17</b><br><b>(M)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 19</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |
| <b>Day 21</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                             |               |                             |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

# Data Collection: Experiment 2 Pinto Beans

Our group's growing conditions: \_\_\_\_\_

| Time                 | My Group's<br>Pinto Bean 1                        | My Group's<br>Pinto Bean 2                        | Partner Group's<br>Pinto Bean 1 |               | Partner Group's<br>Pinto Bean 2 |               | Averages<br>(Measurements only) |               |
|----------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------|---------------|---------------------------------|---------------|---------------------------------|---------------|
|                      |                                                   |                                                   | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 0</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 3</b><br>(M)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 5</b><br>(W)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 7</b><br>(F)  | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 10</b><br>(M) | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

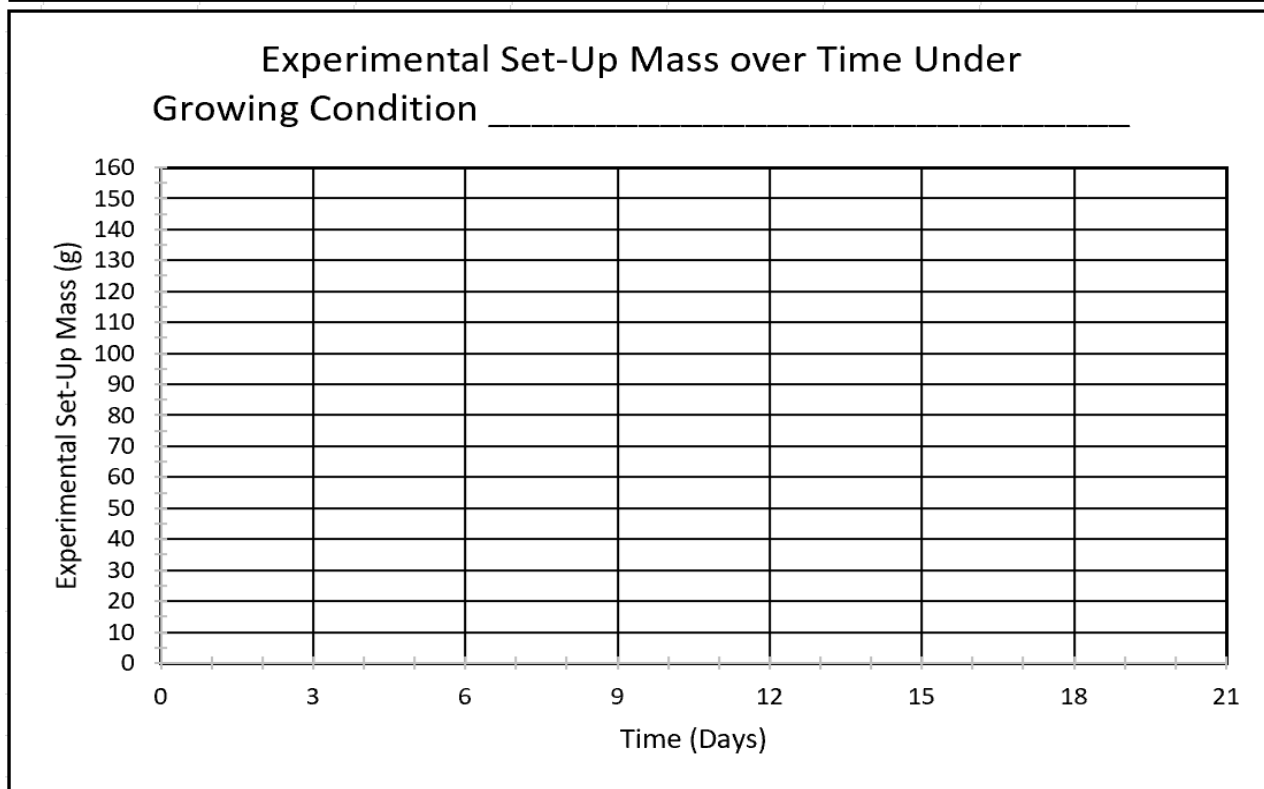
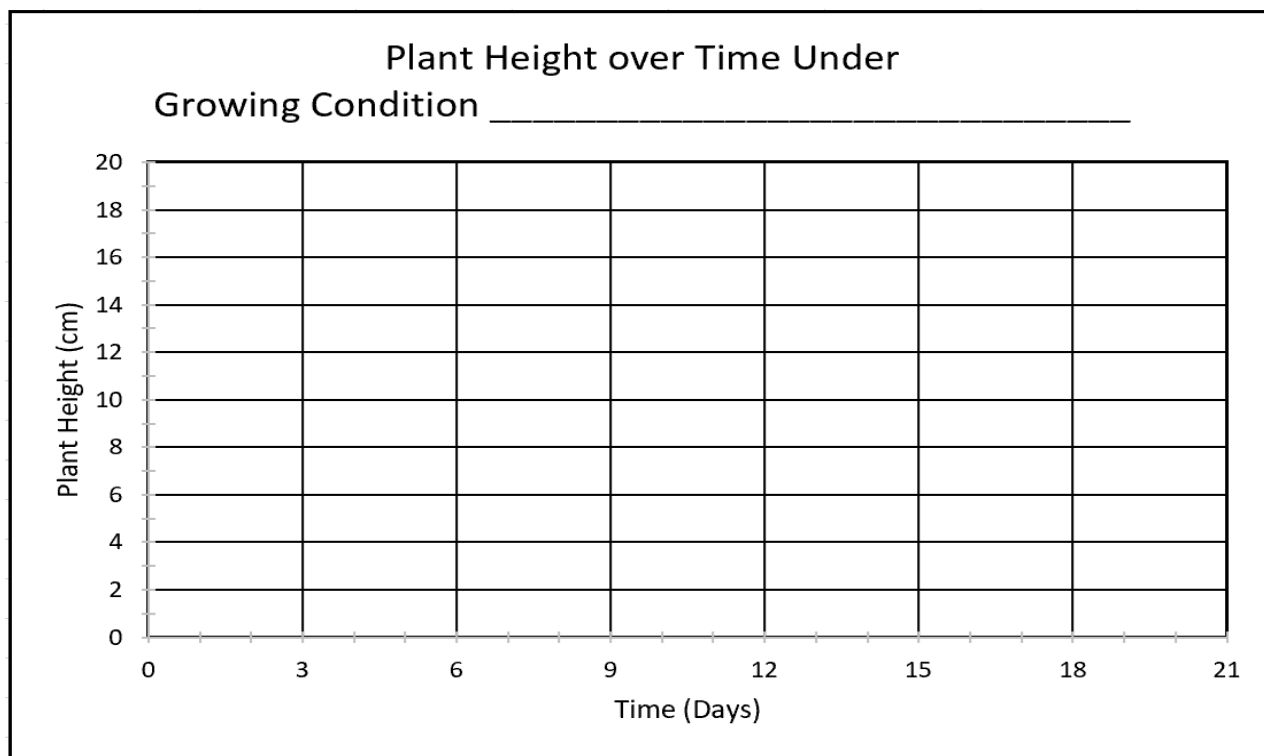
## Data Collection continued: Experiment 2 Pinto Beans

| Time                        | My Group's<br>Pinto Bean 1                        | My Group's<br>Pinto Bean 2                        | Partner Group's<br>Pinto Bean 1 |               | Partner Group's<br>Pinto Bean 2 |               | Averages<br>(Measurements only) |               |
|-----------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------|---------------|---------------------------------|---------------|---------------------------------|---------------|
|                             |                                                   |                                                   | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: | Mass of Set-up:                 | Plant Height: |
| <b>Day 12</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 14</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 17</b><br><b>(M)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 19</b><br><b>(W)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |
| <b>Day 21</b><br><b>(F)</b> | Mass of Set-up:<br>Plant Height:<br>Observations: | Mass of Set-up:<br>Plant Height:<br>Observations: |                                 |               |                                 |               |                                 |               |

\*When taking measurements, only measure only the **TALLEST** plant in the cup.

## Part 8: Data Analysis 2

Use the graph below to plot your data. Graph only the average values for your and your partner groups' plants. Use a **red** pencil to plot the points for the radishes and a **black or gray** pencil to plot the points for the pinto beans. Fill in your group's growing condition in the blank in the graph title.



Once you've graphed your data here, go to the Class Data file in Google sheets. You and your partner groups will input your data to create two graphs. One partner group will create the plant height graph and the other partner group will create the experimental set-up mass graph.

## Part 9: Conclusions

16. Despite having no soil in Exp 2, we still observed plant growth in some cases. What does this tell us about where plants get the material they need to grow?

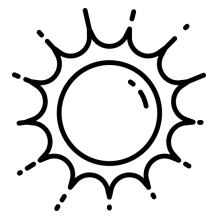
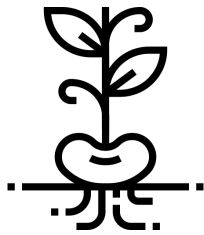
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17. When we re-measure the mass of the soil from an Exp 1 plant, what should we expect to happen?

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18. Was our prediction correct?      YES                      NO

(Circle one)



19. How did the plant height for both plants change over time in the **light & air** experiment?

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20. How did the plant height for both plants change over time in the **dark & air** experiment?

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21. From this we can conclude \_\_\_\_\_

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22. How did the plant height for both plants change over time in the **light & little to no air** experiment?

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23. How did the plant height for both plants change over time in the **dark & little to no air** experiment?

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24. From this we can conclude \_\_\_\_\_

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25. Do the results from the plants in the dark in experiment 2 support our conclusions about plants in the dark in experiment 1?      YES                      NO

(Circle one)



26. In Experiment 2, the water amount from Day 0 to Day 21 differed by \_\_\_\_\_ g. This tells us that

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27. In Experiment 2, the plants grown with little to no air had a **small** **large** mass difference as  
(Circle one)

compared to the plants grown with air. This tells us that \_\_\_\_\_

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28. From these experiments, we can conclude that plants get the materials they need to grow chiefly from

\_\_\_\_\_ and \_\_\_\_\_, and in order to maintain their growth, they  
need to have access to \_\_\_\_\_.