DATA AND GRAPHS
PRACTICING SCIENCE SKILLS

TEK:
Learning Lab: Data Analysis and Graphing Skills
Student Response Pages

Objective: Students will learn how to set up data tables and graphs in a science based situation

ATL Skill: Critical Thinking – Interpret data

TEKS: 8.3A in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student

Directions: Rotate to each station as instructed. Your goal is to complete each station by completing the action required and responding on your lab page.

Part I: Making Data Tables

Making a Table -

Any time data is collected in an experiment, it is most often presented in a table. The data table must have a title, rows, columns, and headings. The title should be placed at the top and tells the observer what information is contained in the table. At the top of each column should be a “head” that tells you what information is in the column.

Pick up the reference page at this station. Keep it to use all year in science class.

Table 1 Title: __________________________________________________________

Independent Variable: ____________________________________________

Dependent Variable: ____________________________________________
Making data tables

- Pick up this page. It is yours to keep as a reference for the rest of the year.

**Making a Data Table**

Guidelines for Making a Data Table -

In most cases, the independent variable (that which you purposefully change) is in the left column, the dependent variable (that which you measure) with the different trials is in the next columns, and the derived or calculated column (often average) is on the far right. Rows are a series of horizontal cells and that columns are a series of vertical cells.

Title: Clearly state the purpose of the experiment (e.g., The effect of ___ (independent variable) on _____ (dependent variable).

<table>
<thead>
<tr>
<th>Independent Variable (unit)</th>
<th>Dependent Variable (unit)</th>
<th>Derived Quantity (unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example Data Table:

Title: The pH of Common Household Substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>pH</th>
<th>Average pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon juice</td>
<td>2.4</td>
<td>2.2</td>
</tr>
<tr>
<td>Baking soda</td>
<td>8.4</td>
<td>8.5</td>
</tr>
<tr>
<td>Orange juice</td>
<td>3.5</td>
<td>3.6</td>
</tr>
</tbody>
</table>
Making data tables

- Work through the problems at this station (use the reference page to help you):

### Part 1: Making Data Tables

#### Table 1:

For each example, identify the independent and dependent variables and create a data table to organize the information in. Draw the data table in the space provided on your response page. Remember to follow all the guidelines for making data tables.

Allison wanted to find out if the color of soda affected whether her friends would choose a particular one. She collected the following data:

- Orange Soda – 5 friends
- Yellow Soda – 7 friends
- Green Soda – 2 friends
- Clear Soda – 1 friend
- Brown Soda – 15 friends

**Independent Variable:** __________________________

**Dependent Variable:** __________________________

Does the color of soda affect the number of friends that drink it? (Answer the question on your lab page)
Analysis of Data:

- Read table, answer questions

### Part II: Analysis of Data Tables

Reading a data table: Examine the data found in the table and answer questions #1-4 on your response page.

**Table: Growth of eight plants in a three week period**

<table>
<thead>
<tr>
<th></th>
<th>Amount of Light per day</th>
<th>Amount of Water per day</th>
<th>Height Week 1 in cm</th>
<th>Height Week 2 in cm</th>
<th>Height Week 3 in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant 1</td>
<td>0 hours</td>
<td>¼ cup</td>
<td>0 cm</td>
<td>0 cm</td>
<td>0 cm</td>
</tr>
<tr>
<td>Plant 2</td>
<td>0 hours</td>
<td>1 cup</td>
<td>0 cm</td>
<td>0 cm</td>
<td>0 cm</td>
</tr>
<tr>
<td>Plant 3</td>
<td>4 hours</td>
<td>¼ cup</td>
<td>1 cm</td>
<td>3 cm</td>
<td>6 cm</td>
</tr>
<tr>
<td>Plant 4</td>
<td>4 hours</td>
<td>1 cup</td>
<td>0.5 cm</td>
<td>1 cm</td>
<td>1.5 cm</td>
</tr>
<tr>
<td>Plant 5</td>
<td>8 hours</td>
<td>¼ cup</td>
<td>1.5 cm</td>
<td>4 cm</td>
<td>8 cm</td>
</tr>
<tr>
<td>Plant 6</td>
<td>8 hours</td>
<td>1 cup</td>
<td>1 cm</td>
<td>3 cm</td>
<td>6 cm</td>
</tr>
<tr>
<td>Plant 7</td>
<td>16 hours</td>
<td>¼ cup</td>
<td>1 cm</td>
<td>2 cm</td>
<td>3 cm</td>
</tr>
<tr>
<td>Plant 8</td>
<td>16 hours</td>
<td>1 cup</td>
<td>1.5 cm</td>
<td>5 cm</td>
<td>10 cm</td>
</tr>
</tbody>
</table>

1. In this plant growth experiment, what were the two variables tested?

2. What conclusions can you draw in regards to the amount of light a plant was exposed to and how tall the plant grew?
Examining Graphs

Several stations looking at graphs:

EXAMINING GRAPHS

Plant Growth in Various pH Soils

A team of botanists conducted an experiment to investigate the effect of the outside temperature on the time required to melt a s'more in the solar oven. They hypothesized that the warmer it was outside, the more quickly the s'more would melt.

1. Was Perry's hypothesis correct? Explain your answer.
2. If Perry tested his hypothesis on a day when the temperature was 77°F, based on this trend, how long should he expect it to take for the s'mores to melt?
3. If Perry tested his hypothesis on a day when the temperature was 100°F, based on this trend, how long should he expect it to take for the s'mores to melt?
Critiquing “Bad” Graphs:
Making graphs

- For these next few stations, you will be required to:
  - Make a table and a line graph
  - A Bar graph
  - Circle or pie graph
A. Making a Table

Any time data is collected in an experiment, it is most often presented in a table. The data table must have a title, rows, columns, and headings. The title should be placed at the top and tells the observer what information is contained in the table. At the top of each column should be a “head” that tells you what information is in the column.

Read the paragraph below. Use the information to complete a table.

An experiment was conducted to measure the amount of oxygen consumed during cellular respiration by germinating seeds at two different temperatures. Measurements were taken every two minutes for 10 minutes. The first set of seeds was kept in a cold environment in which the temperature was maintained at 10°C. The measurements (showing cumulative oxygen consumption) obtained at 2-minute intervals were: 1 mL, 1.8 mL, 2.7 mL, 3.6 mL, and 4.5 mL. The second set of seeds was kept in a warm environment in which the temperature was maintained at 24°C. The measurements (showing cumulative oxygen consumption) obtained at 2-minute intervals were: 2 mL, 3.1 mL, 4.3 mL, 5.6 mL, and 6.5 mL.
B. Making a Line Graph

Line graphs show data plotted as points that are connected by a line. Line graphs are often used to show change over time and can be used to compare two or more sets of data.

Before a line graph can be constructed, you must identify the two variables that will serve as x and y coordinates on the graph. These are called the “independent variable” and the “dependent variable”.

The independent variable is the one being manipulated or changed during the experiment. It is always placed on the x-axis or horizontal axis. The dependent variable is the observed result of the independent variable being changed. The dependent variable is always placed on the y-axis or vertical axis. An easy way to remember this is to ask yourself the questions, “What did I know before I did the experiment?” (independent variable) and “What did I learn by doing the experiment?” (dependent variable)

Using a piece of graph paper, or the student worksheet if one was provided by your teacher, graph the information that you placed in your newly constructed data table in Part A. Remember: Since you were comparing seeds at two different temperatures, there should be two different lines plotted on your graph.

Be sure to: (1) Label each axis appropriately, (2) Scale each axis appropriately, (3) Title your graph, (4) Label each of the two lines on your graph.
C. Making a Bar Graph

Bar graphs are useful for showing comparisons of data collected by counting. A bar graph has two axes, a horizontal axis and a vertical axis. Generally the horizontal axis is labeled and the vertical axis is divided. The data are not related so the bars do not touch.

Using a piece of graph paper, or the student worksheet if one was provided by your teacher, make a bar graph of the following information:

Students were surveyed to determine what part of the school day was their favorite. Students could choose only one of the following categories as their favorite part of the school day:

<table>
<thead>
<tr>
<th>Part of the School Day</th>
<th># of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math Class</td>
<td>15</td>
</tr>
<tr>
<td>Science Class</td>
<td>25</td>
</tr>
<tr>
<td>English Class</td>
<td>8</td>
</tr>
<tr>
<td>History Class</td>
<td>10</td>
</tr>
<tr>
<td>Gym</td>
<td>46</td>
</tr>
<tr>
<td>Lunchtime</td>
<td>73</td>
</tr>
</tbody>
</table>
D. Making a Circle Graph

A circle graph is used to show how a certain quantity is broken down into parts. The circle represents the whole, and the “slices of the pie” represent the portions of the whole. In a circle graph, be sure to label the sections so that the data is shown.

Using your notebook paper, or the student worksheet if one was provided by your teacher, make a circle graph of the following information:

People were surveyed to determine what color automobile they would prefer. The results were:

- Grey – 50%
- Red – 25%
- White – 10%
- Blue – 10%
- Beige – 5%
Graphing quiz next class!

For any graph, be sure to:

- Label the x (independent) axis, y (dependent) axis
- Title the graph
- Connect the plotted points in a line or bars
  (depends on the purpose of the graph which type of graph you choose)