

Unit #1 - Being a Scientist

Scientific Inquiry

Name: _____

Date: ___/___/___

Period: ___

• How do scientists plan an investigation?



Scientific Inquiry Parts	Description and Examples	Practice
Scientific Questions	Scientific inquiry often begins with a question about an observation, experience, or inference. Scientists make observations about the world around them. These observations lead the scientist to ask scientific questions!	<p><u>Observation:</u> <i>You receive a flower from a friend. You have heard that adding sugar to the flower's water keeps the flowers fresh.</i></p> <p><u>Scientific Question:</u> <i>Does adding sugar to water keep flowers fresh?</i></p>
Hypothesis	A hypothesis (plural: <i>hypotheses</i>) is one possible explanation for an observation or one possible answer to a scientific question that must be able to be tested through an investigation. A hypothesis often takes the form of an <i>If...then...</i> statement. <i>*When you communicate your findings in a lab report, you will decide if your hypothesis was SUPPORTED (Correct) or NOT SUPPORTED (Incorrect).</i>	<p><u>Hypothesis:</u> <i>If I add sugar to the flower's water, then the flowers in sugar water will lose fewer petals and wilt less quickly than flowers in plain tap water.</i></p> <p><i>If I add sugar to the flower's water, then the flowers in sugar water will be healthier than the flowers in plain tap water.</i></p>
Prediction	A prediction is a statement explaining what you think will happen in an investigation. Predictions should be specific. Use your knowledge and experience to make a reasonable prediction. <i>*When you communicate your findings in a lab report, you will decide if your prediction was ACCURATE (Correct) or NOT ACCURATE (Incorrect)</i>	<p><u>Prediction:</u> <i>The flower in the container with sugar will not lose any petals during the observation period.</i></p> <p><i>The flower in the container with sugar will not wilt.</i></p> <p><i>The flower in the control container will wilt and lose petals.</i></p>

Plan the Investigation	When you plan an investigation, you will make many decisions. Depending on the type of investigation method you choose, the plan will sometimes vary.																								
Controlling Variables	<p>Every investigation involves several variables. Variables are any factor that can change in an investigation.</p> <p>Controlling variable means keeping all conditions the same except for one variable.</p> <p>The one variable that changes in an investigation is called the manipulated variable.</p>	<p style="text-align: center;"><u>Variables</u></p> <table border="1" style="width: 100%;"> <tr> <td data-bbox="846 226 1218 554"> <p><u>Controlled Variables:</u></p> <ul style="list-style-type: none"> • <i>Same size and type of container</i> • <i>Amount of water</i> • <i>Flower type and size</i> • <i>Age of flower</i> • <i>Amount of sunlight</i> • <i>Room Temperature</i> </td> <td data-bbox="1218 226 1549 554"> <p><u>Manipulate Variable:</u></p> <ul style="list-style-type: none"> • <i>Sugar – the sugar containers will have sugar and the control containers will not have sugar.</i> </td> </tr> </table>	<p><u>Controlled Variables:</u></p> <ul style="list-style-type: none"> • <i>Same size and type of container</i> • <i>Amount of water</i> • <i>Flower type and size</i> • <i>Age of flower</i> • <i>Amount of sunlight</i> • <i>Room Temperature</i> 	<p><u>Manipulate Variable:</u></p> <ul style="list-style-type: none"> • <i>Sugar – the sugar containers will have sugar and the control containers will not have sugar.</i> 																					
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Trial	<p>Trials are when an investigation is repeated.</p> <p>The more trials done, the more reliable the data collected.</p>	<p><u>Trials:</u></p> <p><i>One Trial will be conducted. There will be one flower in water with sugar and one flower in plain tap water.</i></p>																							
Procedure	<p>A procedure is the steps that will be followed in an investigation. It is most often a numbered list.</p> <ul style="list-style-type: none"> • When planning an investigation, procedures are a plan. • When doing the investigation, it is important to note any changes in the procedure. <p><i>*When you communicate your findings in a lab report, it is important to include and explain any changes to the procedure.</i></p>	<p><u>Procedure:</u></p> <ol style="list-style-type: none"> 1. <i>Collect two graduated cylinders & label:</i> <ol style="list-style-type: none"> a. <i>Mark one – “Sugar”</i> b. <i>Mark one – “Control”</i> 2. <i>Add 200 mL of tap water to each graduated cylinder.</i> 3. <i>Add 11 g of sugar to the 1 graduated cylinder labeled “Sugar.”</i> 4. <i>Cut about 4 cm from the stem of each flower at an angle.</i> 5. <i>Place one flower in each graduated cylinder.</i> 6. <i>Place all graduated cylinders in a well-lit area, but not in direct sunlight.</i> 7. <i>Record observations for five days.</i> 8. <i>Analyze data.</i> 9. <i>Make conclusions.</i> 																							
Data Table	<p>Data is the facts, measurements, and other evidence collected in an investigation. Data can be qualitative or quantitative observations.</p> <p>We create a data table before investigating and use it to collect data throughout the investigation.</p> <p>Data Table and Charts include:</p> <ul style="list-style-type: none"> • Include Title & Labels • Rows – across • Columns – up and down 	<p><u>Data Table:</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3" style="text-align: center;">Flower Observations</th> </tr> <tr> <th rowspan="2" style="text-align: center;">Day</th> <th colspan="2" style="text-align: center;">Trial A</th> </tr> <tr> <th style="text-align: center;">Control</th> <th style="text-align: center;">Sugar</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">2</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">3</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">5</td> <td></td> <td></td> </tr> </tbody> </table>	Flower Observations			Day	Trial A		Control	Sugar	1			2			3			4			5		
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<p>Materials</p>	<p>Materials are the supplies that you use in an investigation. Different investigations You will need different materials for.</p> <p>You should make a list or review the list provided by the teacher to make sure you will be able to do the investigation – know where and how you will get all materials.</p> <p>When doing the investigation, it is important to note any changes in the materials list.</p> <p><i>*When you communicate your findings in a lab report, it is important to include and explain any changes to the materials list.</i></p>	<p><u>Materials:</u></p> <ul style="list-style-type: none"> • <i>2 - 250 mL Graduated Cylinders</i> • <i>400 mL Water</i> <i>(200 mL Water in all Graduated Cylinders)</i> • <i>11 g Sugar</i> • <i>2 Flowers (Gerber Daisies)</i> • <i>Scissors</i> • <i>Labels</i> • <i>Marker</i> • <i>Sunlight</i> • <i>Paper</i> • <i>Pencil</i> <p><u>Special Note:</u> Benefit from Sugar Solution: Baby's Breath, Lilies, Peonies, Physostegias, Platycodons, and Snapdragons. Benefit from 6% Sugar Solution: Gerber Daisies and Gladioli Do not Benefit: Daffodils, Marguerite Daisies, and Tulips.</p>
<p>Operational Definitions</p>	<p>An operational definition is a statement that describes how a particular variable is to be measured, or how an object or condition is to be recognized. Operational definitions tell you what to do or what to observe.</p> <p>Ex: A bird is an animal that has two feet, a pair of wings, and feathers.</p>	<p><u>Operational Definitions:</u></p> <p><i>Healthier Flowers: A flower is healthy if the flower retains its color, does not wilt, and does not lose petals.</i></p> <p><i>Wilt: When the flower petals become limp and droop.</i></p>
<p>Gathering Data</p>	<p>Depending on the method of inquiry – Descriptive, Correlation, or Experimental – you will make observations and gather data in different ways to record in your data table:</p> <p>Descriptive: Observations of an <u>event or group</u> with no testing involved.</p> <p>Correlational: Observations of <u>collected data</u>.</p> <p>Experimental: Observations from <u>test results</u>.</p>	<p><u>Gathering Data:</u></p> <p><i>In this experiment, each day the student would make observations about the flowers and record these observations in their data table.</i></p> <p><u>Examples:</u></p> <p>Descriptive: <i>If studying animal patterns, each day the scientists would make observations of animal behavior.</i></p> <p>Correlational: <i>If study trends in advertising, the researcher would observe sales data and survey data to look for correlations between two events like a new commercial and sales.</i></p> <p>Experimental: <i>If studying which car is the safest, scientists would crash each car in the same manner and then record observations and measurements.</i></p>

<p>Analyze Data</p>	<p>After your data has been collected, data needs to be interpreted.</p> <p>Analyze... ...comes from Greek:</p> <ul style="list-style-type: none"> • ana means to “break apart” • lyze means “to loosen” <p>...<u>look closely</u> at <u>each detail</u> to find out what it means.</p> <p>One tool that can help interpret data is a graph. We ask ourselves:</p> <ul style="list-style-type: none"> • What do the data tell us? • Is the data accurate? <p>We look for patterns in the data.</p> <p>We summarize our data findings – What does the data say? If correlational, is there a positive correlation or negative correlation. Positive $\geq 50\%$ Negative $< 50\%$</p>	<p><u>Analyze Data:</u></p> <div data-bbox="862 174 1536 835" data-label="Figure"> <table border="1"> <caption>Number of Flower Petals in Observation Period</caption> <thead> <tr> <th>Observation Day</th> <th>Sugar</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10</td> <td>10</td> </tr> <tr> <td>2</td> <td>10</td> <td>10</td> </tr> <tr> <td>3</td> <td>10</td> <td>9</td> </tr> <tr> <td>4</td> <td>10</td> <td>9</td> </tr> <tr> <td>5</td> <td>10</td> <td>7</td> </tr> </tbody> </table> </div> <p><i>This data indicates that the flower in the sugar water did not lose petals, and the flower in the plain tap water did lose petals.</i></p>	Observation Day	Sugar	Control	1	10	10	2	10	10	3	10	9	4	10	9	5	10	7
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<p>Conclusion</p>	<p>A conclusion is a summary of what you have learned from an investigation. To draw conclusions, you must examine your data objectively to see if the data supports or does not support your hypothesis. You must also consider if your prediction is accurate or inaccurate.</p> <p><i>Conclusion:</i></p> <ul style="list-style-type: none"> • <i>What did you learn?</i> • <i>Was your hypothesis supported or not supported? Why?</i> • <i>Was your prediction accurate or inaccurate? Why?</i> 	<p><u>Conclusion:</u></p> <p><i>In this experiment, I learned that a cut fresh flower can be affected by adding sugar to the water.</i></p> <p><i>My hypothesis was supported by the data. Sugar in cut flowers' water helps the flower stay fresh longer than it would in water without any sugar.</i></p> <p><i>My prediction was accurate. I predicted the control flower will wilt and lose petals and it did lose petals and began to wilt on day 5.</i></p>																		
<p>New Scientific Questions</p>	<p>Scientific inquiry usually doesn't end once an investigation is done. Often, one investigation will lead to more questions and more investigations!</p>	<p><u>New Scientific Questions:</u></p> <p><i>Is this true of all types of flowers?</i></p> <p><i>How long before the flower in sugar water will wilt and lose color?</i></p>																		

