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

**Student Exploration: Measuring Trees**

**Vocabulary:** circumference, cross section, diameter, drought, growth ring, precipitation

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

1. Trees grow throughout the year. During which season(s) do you think trees grow fastest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. During which season(s) do trees grow most slowly? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What weather conditions could make trees grow more quickly than normal? \_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What weather conditions could make trees grow more slowly than normal? \_\_\_\_\_\_\_\_\_\_\_\_\_

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**Gizmo Warm-up**

The *Measuring Trees* Gizmo shows part of a forest. Click tree **E** to select it. On the right side of the Gizmo, a **cross section** of the tree is displayed. Click **Show larger view** for a larger image.

1. The rings on the tree are called **growth rings**. Click **Zoom in** for a clearer view. How many rings can you count? \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Click **Return to forest**, and then click **Advance year** once. How many growth rings are there now? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Click **Advance year** again and count the rings. How many are there now? \_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What does the number of rings tell you about the tree? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Activity A:** **Measuring trees** | Get the Gizmo ready: * Click **Return to forest**, and then click **Reset**.
* Check that the **Preset forest** is shown (text at top). If not, click **Refresh** or **Reload** on your browser.
 | Measuring Trees SE2 |

**Question: How can you measure a tree?**

1. Observe: Look at the trees in the forest.

Which tree do you think is the youngest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Oldest? ­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Collect data: Measure each tree in the following ways. (Tree **A** has been done for you.)
	* Click the tree you want to measure. Estimate the height to the nearest tenth of a meter using the draggable ruler. (For example, the height might be 2.6 meters.)
	* Click **Show larger view**. Determine the age of the tree by counting growth rings. Use **Zoom in** as needed. (Hint: Do not count the bark of the tree as a separate ring.)
	* The **diameter** is the width of the tree trunk. Measure the diameter using the ruler. Write the diameter to the nearest tenth of a centimeter.
	* The **circumference** is the distance around the tree trunk. Click **Find circumference** to measure the circumference to the nearest tenth of a centimeter.

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| --- | --- | --- | --- | --- |
| **Tree** | **Height**  | **Age** | **Diameter**  | **Circumference**  |
| A | 6.9 m | 9 years | 7.4 cm | 23.3 cm |
| B |  |  |  |  |
| C |  |  |  |  |
| D |  |  |  |  |
| E |  |  |  |  |
| F |  |  |  |  |

1. Analyze: How does the age of a tree relate to its size? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Extend your thinking: Compare the circumference values to the diameters. About how many times the diameter is the circumference? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Activity B:** **Tree growth** | Get the Gizmo ready: * If necessary, click **Return to forest** to see the forest view.
 | 666SE2 |

**Question: How does precipitation (rain, snow, sleet, or hail) affect tree growth?**

1. Observe: Use the Gizmo to explore how precipitation affects tree growth. You can alter the amount of precipitation using the slider. Click **Advance year** to advance one year forward.
2. Form hypothesis: If there is more precipitation, how will tree growth change? \_\_\_\_\_\_\_\_\_\_\_\_

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1. Experiment: Click **Reset** and select tree **E**. Set the **Precipitation** to 20 cm per year to show a period of low precipitation, or **drought**. Click **Advance year**. Measure the tree and record its height in the table below. Repeat these steps two more times.

Now set the **Precipitation** to 160 cm per year and click **Advance year** three times, recording the height of the tree after each click in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | 2 | 3 | 4 | 5 | 6 | 7 |
| **Precipitation** | 20 cm/yr | 20 cm/yr | 20 cm/yr | 160 cm/yr | 160 cm/yr | 160 cm/yr |
| **Height** |  |  |  |  |  |  |

1. Analyze: Click **Show larger view**. Click **Zoom in** twice to see the rings up close.
	1. Describe the six outermost rings. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. About how wide are the growth rings for the drought years? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. About how wide are the growth rings for the rainy years? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. Draw conclusions: How does precipitation affect the growth of the tree? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Extension:** **Graphing growth** | Get the Gizmo ready: * If necessary, click **Return to forest**.
* Click **New forest**.
 | 666SE3 |

**Question: At what point in its life does a tree grow most quickly?**

1. Form hypothesis: Do you think a young or old tree grows more quickly? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why do you think so? ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Collect data: Set the **Precipitation** to 120 cm per year. Select a small tree and measure its age and height. Fill in the blank in the **Age** column with the starting age of the tree.

Click **Advance year** until the tree is ten years old and measure its height again. Measure and record the tree’s height at age 20, 30, 40 and 50 as well.

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| --- | --- |
| **Age (years)** | **Height (meters)** |
|  |  |
| 10 |  |
| 20 |  |
| 30 |  |
| 40 |  |
| 50 |  |

1. Make a graph: Plot a point on the graph for each row of data you have. Draw a line to connect the points in order.
2. Analyze: Which part of the graph shows the fastest growth? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do you know? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Extend your thinking: How is the growth of a tree similar to the growth of a person? \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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