**Where Does a Tree Get Its Mass?**

**5E Lesson Plan**

**Materials for unit:**

Index cards

Tree to measure in the school yard

Clinometer or Altitrack (http://www.instructables.com/id/Using-a-clinometer-to-measure-height/)

Tape measure (long clothe)

Calculator

Acorn (Optional)

Tree branch (Optional)

Tree trunk cross section (Optional)

Computer with Internet access

Science textbooks or other resources on plant processes

*Safety Note: Determine a safe area for the students to measure the trees. Check for fire ants, bees, and other dangerous insects before you bring the students outside. Find out if any of your students have dangerous allergic reactions to bites or stings. Have your students work in heterogeneous lab groups of three to four students and stay in the designated area with their lab partners. This lesson is written to be used with sixth through eighth grade students.*

*The students will work in lab groups for most of this unit.*

**Engage:** “What is the mass of the tree outside our school?”

The students will work in lab groups for this part of the unit. This exercise is planned to take one class period of 50 minutes.

1. Group the students in heterogeneous lab groups of 3 to 4 students. Group students in a way that all students have the opportunity to contribute and participate.
2. We began by asking the students what the mass is of the tree outside the building. *“Think about the mass of the tree”.*
3. Have the students (in their lab groups) record their estimates of the mass of the tree on index cards. Remind students to include units.
4. Ask a student from each group to place the index cards on the board grouping them so that they can visualize the range of the estimates of the tree mass. We grouped the estimates by tonnage on the board but you will need to decide if this is helpful based on the estimates of each group (see Figure 1).
5. As a lab group students go to the tree (predetermined) to measure the mass of the tree.

Have the students use a tape measure to determine the circumference of the tree at eye level in inches. (We chose to have students measure in Imperial units because the Forestry Service traditionally uses Imperial units in the United States (Avery & Burkhart 2015). However, students can use metric units and do the conversions.)

Then with a clinometer or Altitrack have each lab group determine the height of the tree (in feet). (See instruction at http://www.instructables.com/id/Using-a-clinometer-to-measure-height/)

1. Have the students determine the diameter of the tree using the formula d=C/π. (Calculator use optional.)
2. Both the diameter and the height estimates might need to be rounded before using the table. Using Table 1 find the estimate of the mass of the tree. If Table 1 does not have the information needed there are other tables available listed in extra resources.
3. Have the students record their results on an index card and post on the board so that everyone can visualize the range of the measured estimates.
4. Have the students compare the distributions of their original estimates and their measured estimates.

**Explore:** “Where did an acorn get the mass to grow into this tree?”

*The students will continue to work in lab groups. The steps 1-4 is planned to take 30 minutes. Steps 5 and 6 will take about 20 minutes of time for the next couple of class periods.*

1. Have the students take the pretest. This can be used as a formative assessment.
2. Show the students the acorn, branch, and cross section of a tree trunk (use pictures if needed but actual materials that the students can pass around and touch is always better). Discuss as a class what each represents.
3. Give all the students acorns.
4. Have the students generate a list of resources the acorn needs to grow. Have the students keep their list and tell them you will revisit the list the next class period.
5. (Following class period) While in their lab groups have the students revisit the list or resources and begin to diagram how each material flowed through a plant. (We had the students revisit their diagrams different class periods for short periods of time discussing ways they could modify their diagrams for accuracy.) Each student drew their own diagram. At the end of this part of the lesson the students chose one diagram to represent their group’s work. Introduce the photosynthesis equation. Have computers and book resources available for the students.
6. Have studentsrevisited their diagrams and use questions to encourage the students to add more details to their diagrams. Some sample questions are “What parts of the plant are involved with each resource?”, “Why is each resource needed by the plant?”, “How is each resource processed by the plant?”, “What would happen to the plant if they didn’t have one of the resources?”, “Where does a plant gets its energy?”, “How does a plant use energy?”, “What parts of the plant are used in photosynthesis?”, and “If a plant doesn’t use all of its energy what happens to the energy?” “Do leaves need to be green?”

# Explain: Video “Where Do Trees Get Their Mass From?” The students will continue to work in lab groups. The video and discussion will take about 20 minutes.

# Show the four-minute video.

# After the video review the concepts presented. Allow the students (with their lab group) to review and revise.

**Elaborate:** *Leaf Photosynthesis* ([https://authoring.concord.org/activities/1008/)](https://authoring.concord.org/activities/1008/%29)

The students will continue to work in lab groups. This activity take a 50-minute time block

1. Have the students work through the activity associated with *Leaf Photosynthesis* in their lab groups. Give each student a hard copy of the activity to complete (you can print a copy of the students work from the site by using the print button at the top left side of the page). The students can complete the activity by writing their answers and sketching the diagrams when the activity asked them to take a snapshot.
2. When students have completed the computer activity, have them write summarizing paragraphs in response to the following questions: “Where does a tree get its mass?”, “Explain what a tree (plant) needs to grow”, “Why did your lab group pick the diagram of photosynthesis?”, and “What are the diagram’s strengths and weaknesses in showing the relationship between photosynthesis and the mass of a tree?” in their interactive notebook.
3. Review the activity with the whole class.
4. Give each group time to revisit their lab group’s diagram to review and revise.

**Evaluate**: Posttest

1. Give each student the posttest to evaluate their understanding.
2. (Optional) Have the students compare their pretest understandings to the posttest understandings.

**Helpful Resources**

Concord Consortium. (2017). *Activity: Leaf photosynthesis.* Retrieved from https://authoring
.concord.org/activities/1008/

D'Augustino, T. (2015). "Where do trees get their mass from?". 2017, from <http://msue.anr.msu.edu/news/where_do_trees_get_their_mass_from>

dmaldoonlla (2013). "Using a Clinometer to Measure Height." from <http://www.instructables.com/id/Using-a-clinometer-to-measure-height/.>

Ray, C. D. (2017). "Calculating the Green Weight of Wood Species." 2017, from [http://extension.psu.edu/natural-resources/forests/woodpro/technotes/calculating-the- green-weight-of-wood-species.](http://extension.psu.edu/natural-resources/forests/woodpro/technotes/calculating-the-%09green-weight-of-wood-species.)

Veritasium (2012). "Where Do Trees Get Their Mass From? ." 2017, from <https://www.youtube.com/watch?v=2KZb2_vcNTg.>