



Upham Woods Grab and Go: Value of a Tree

Concept:

Students will be able to create their own clinometer to measure the height of a given tree.

Age level:

5th Grade - Adult

Education Standards:

MS-PS1-3; MS-ESS3-3; HS-LS2-4;
HS-ESS3-6

Success Indicator:

Participants will know how to properly use a clinometer. Use tools and basic math to determine the size and potential of a tree

Background Information:

Functions of a tree: Ask the students what trees do for us. Many answers may arise: lumber, shade, habitat for animals, intrinsic value and perhaps the concept of turning carbon dioxide into oxygen. All of these are excellent examples of the benefits of trees.

Timber value is the main reason for harvesting a tree but there are many uses for trees and recently there has been a big push for renewable biofuels. Normally the tops and limbs of the trees, also called slash, are left on the ground near the site landing and are later burned. They burn the slash piles for site prep so it is easier when they come back to plant and it also helps remove some threat if a wildfire were to come through the area. So instead of burning the piles and releasing that CO₂ to the atmosphere it is now collected and are turned into aviation fuel, among other things.

Biofuels refers to any energy made from renewable plant and animal materials. To be technical, a biofuel could be something as simple as burning the leftover biomass to create power. However, the biofuels we are talking about and the energy we would like to create require a bit more processing than that. First, it is important to remember that plants are made from cellulose. Cellulose is a long, linked chain of sugar molecules that give plant cell walls their strength. To harvest biofuels from the woody biomass, these sugars must be extracted and broken down. This is not humanly possible, so we turn to microorganisms and fungi to help us. Just like how bakers use yeast to make their bread rise, scientists are turning to microbes to break down the cellulose into a usable fuel product.

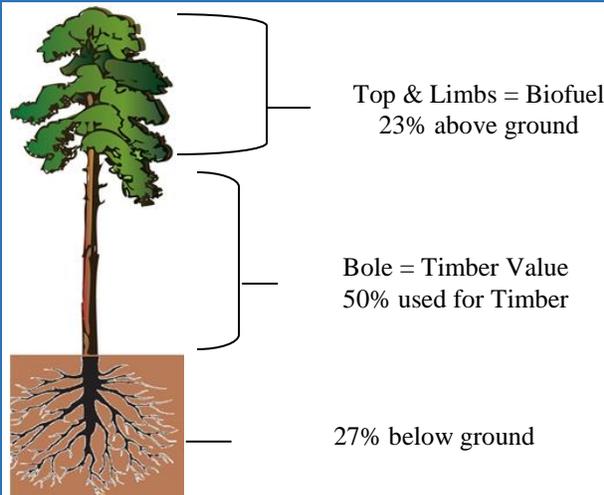
Preparation

Time: 20-30 Minutes

Space: Outdoor area with trees

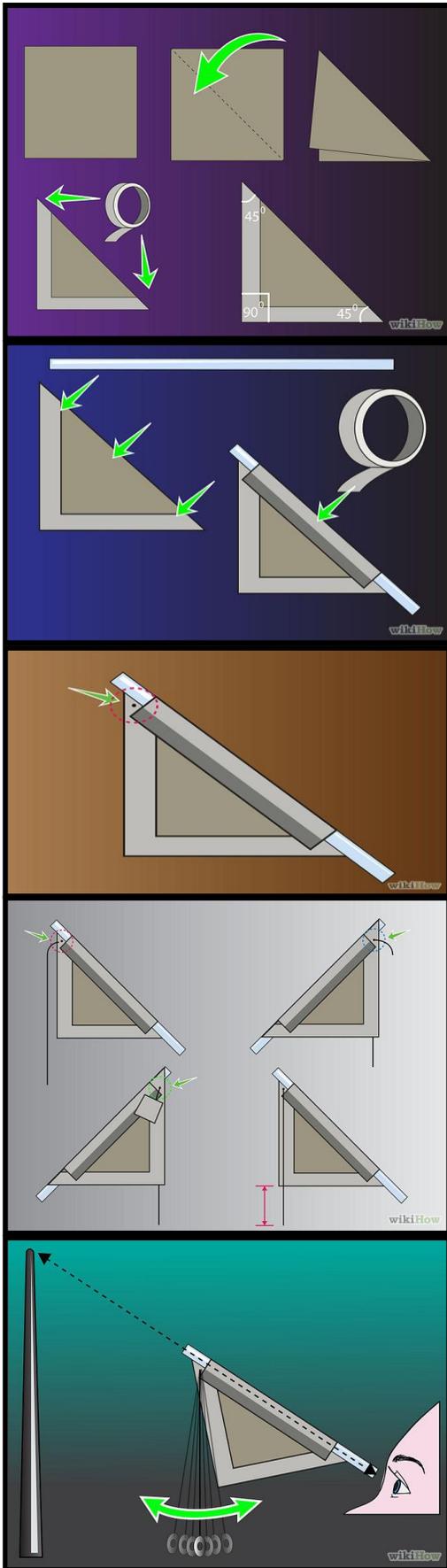
Materials:

- Paper
- Scissors
- Tape
- A straw
- Pencil
- String
- Weighted item
- Measuring Tape



Activity:

Your students will be making



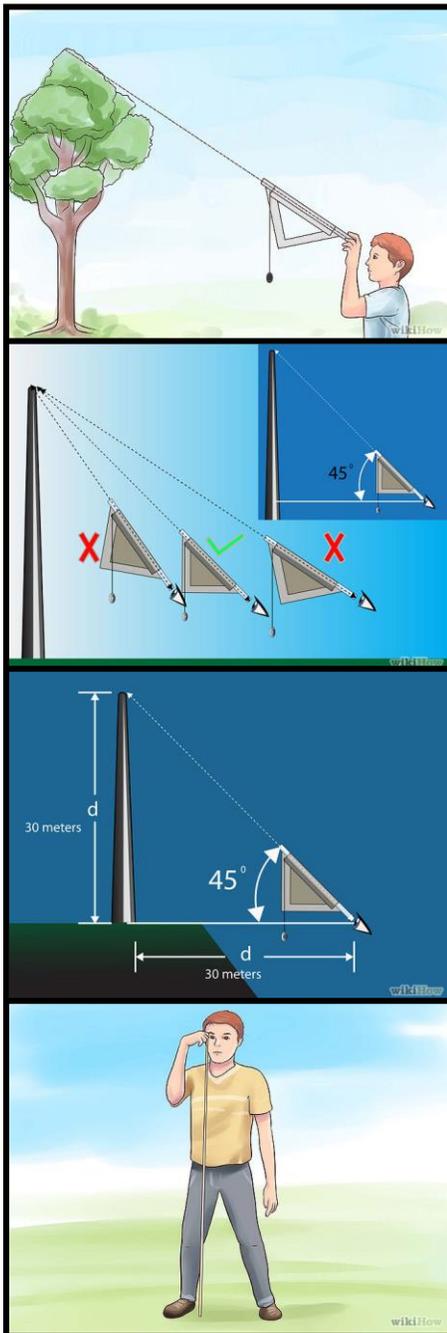
1. Fold a piece of paper into a triangle. Fold the bottom right corner over to touch the left side of the paper, lining up the sides exactly to form a triangle. If you are using an ordinary rectangular sheet of paper, there will probably be an unfolded "extra" section above this triangle. Cut or tear this section off. What you are left with is an equilateral right triangle, with one 90° angle and two 45° angles. Construction paper will make a more durable clinometer, but you can use any sheet of paper. You may want to tape or glue the triangle together to make it sturdier.

2. Tape a straight drinking straw to the triangle's longest side. Position a drinking straw along the longest edge of the triangle, or hypotenuse, so that one end extends slightly out from the paper. Make sure the straw isn't bent or crushed, and runs straight along the hypotenuse. Use tape or glue to secure it to the paper. You will be looking through this straw when using the clinometer.

3. Punch a small hole next to the end of the straw. Choose the end of the straw that is level with the corner, not the one where the straw extends beyond the paper. Use a hole punch or a sharp pen to make a hole in the triangle near this corner.

4. Attach a string through the hole. Push a string through the hole, then tie a knot or tape it to keep it from slipping back out. Use enough string that you have at least a few inches (several centimeters) dangling at the bottom of the clinometer.

5. Tie a small weight to the bottom end of the string. Use a metal washer, a paper clip, or another small object. The weight should dangle 2 inches (5 cm) or more below the corner of the clinometer so that the string will swing freely.



1. Sight the top of a tall object through the straw. Hold the longer end of the straw next to your eye and point it at the top of a tall object you want to measure, such as a tree. Most likely, you'll have to tilt the triangle in order to see the top of the object you're aiming for.

2. Move forward or backward until the string lines up with the triangle. In order to measure the tree, you need to find a spot to stand where you can hold the triangle completely flat and still see the top of the object through the straw. You can tell when the triangle is flat, because the weight will pull the string down exactly in line with one of the triangle's short sides.

- When this happens, it means the angle of elevation between your eye and the top of the object is 45 degrees.

- If you crouch or stand on an object to find a better position, you'll need to measure your height at eye level while in that position, instead of when standing normally as described in a later step.

3. Use a tape measure to find the distance between this position and the base of the tall object. Just like the triangle you're holding, the giant triangle formed by you, the base of the tall object, and the top of the object has two 45° angles and one 90° angle. The two shorter sides of a 45-45-90 triangle are always the same length. Measure the distance between the position you were standing in at the end of the last step, and the base of the tall object you are measuring. The result is almost the height of the tall object, but there's one more step to get your final answer.

4. Add your height at eye level to get the final answer. Because you held the clinometer at eye level, you actually measured the height of the object starting at your eye's height above the ground.[1] Use a tape measure to find out how tall you are from the ground to your eye level, add the result to the number you measured in the last step. Now you know the full height of the object!

Deeper Thinking:

1. What else could you measure with your clinometer?
2. What do you think Value of a Tree means?
 - a. What are some things you think that might affect a trees value?
3. What are some uses of trees you can think of?