

Measuring the Height of Gamow Tower



Name 1: _____

Name 2: _____

Name 3: _____

Your TA or LA will probably ask you to work in a group on this exercise. Write down all names, but you only need to turn in one paper.



Big Idea

Science involves using creativity and imagination to figure things out. In Astronomy we often have to measure things we can't touch because they are so far away. Whenever you measure something it is important to understand the how accurate the measurement is.

Learning Goals

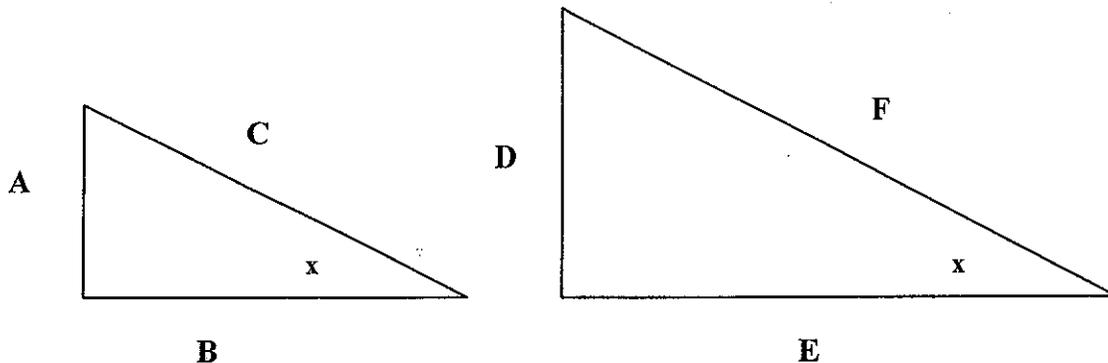
- Measure the size of something (Gamow Tower) you cannot touch.
****Use creativity in devising your own method to do this****
- Learn how to estimate the accuracy of your measurement.

IMPORTANT NOTE: Many labs are like cookbooks –they tell you what to do. That is not the way real science works. *Real science* (as opposed to boring classroom science) is all about using your imagination.

Activity:

Experimentation: "Gamow Tower"

- Part 1: Your apparatus includes a meter stick and a large cardboard triangle whose sides are in a ratio of 2 to 1.
 - Use creativity in devising your own method to do this. Your LA will probably ask you to work in groups, e.g. of 3. You only need to submit one answer but put all names on it!
 - **HINT:** The following two triangles are *similar* and the sides are in the ratio of 2 to 1. Triangles are similar if the *corresponding angles are equal*, and that's true here. So the ratios of any two sides in the first triangle are equal to the ratios of the corresponding sides in the second triangle. If $A=1''$ how large is B ? Answer: $B=2''$ If $D = 50$ feet, how large is E ? **Write your answer here and show it to your TA or LA:** _____



Mathematically, $A/B = D/E$.

- You could also use trigonometry if you measured the angle x . The ratios A/C and B/C are called the *sine* and *cosine* of the angle x , and A/B is the *tangent*. So you could measure one side, and an angle (if you had a protractor) and figure out the other side. But you don't need to, because we've already told you the sides are in a ratio of 2 to 1.

Sketch your method of measuring the tower here:

Show the drawing to your TA or LA **BEFORE** you do your measurements!

Question(s):

I.1) What is the height of Gamow? _____
(units)

Learning Goal II: Learn how to estimate the accuracy of your measurement.

Question(s):

II.1) What do you think is the accuracy of your measurement? Think about this carefully, please.

_____ (units)

II.2) How did you estimate your uncertainty?

Part of a **scientific attitude** means understanding data and the errors that come with it. When someone makes a claim, you *always* should ask, "What data or evidence supports that claim?" *and* "How good is that data?"

II.3) If you compared your measurement of the height of Gamow Tower to the measurement of another group, how different would you expect them to be?

II.4) How does that compare to your estimate of uncertainty?

