

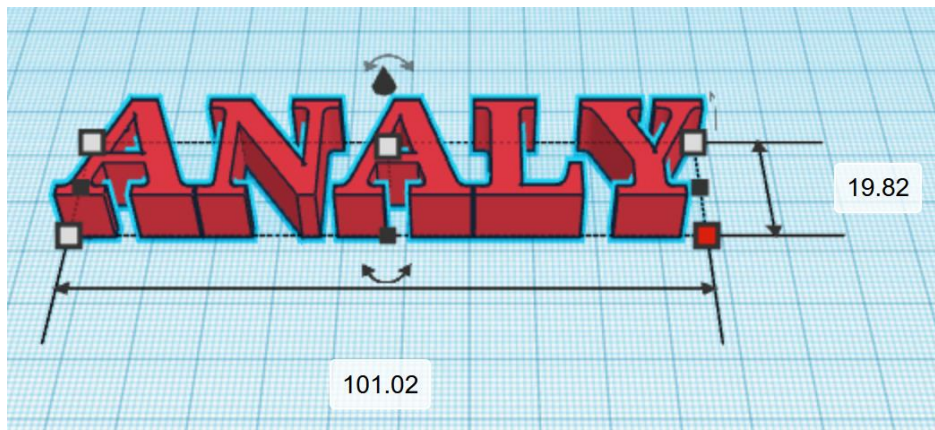
3D Object Volume

Due: 3rd period: Wednesday 3/6/24

4th and 6th periods: Tuesday 3/5/24

When you 3D print something, it becomes a physical object with weight and volume. The things we print are usually quite small, and their weights would typically be measured in grams. 3D printers have all sorts of settings that allow them to make printed objects partially hollow to reduce cost and printing time. Today we're going to do our own version of optimizing an object to reduce its printed volume by reducing the volume of what would be printed.

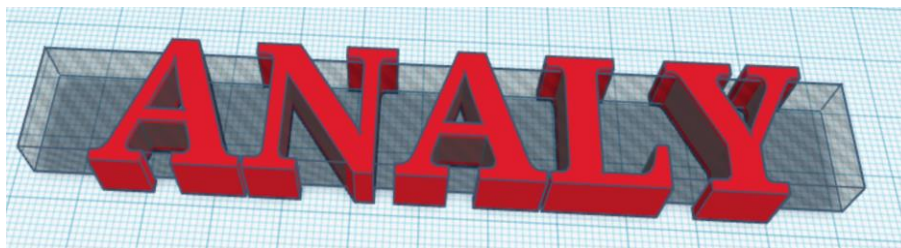
We're all starting with the same thing: the word "ANALY" in Tinkercad.



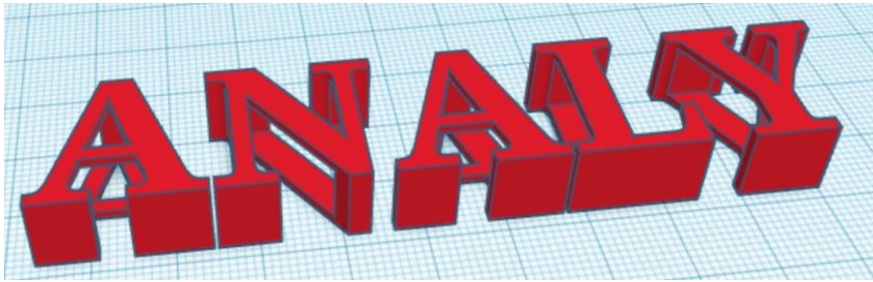
There is a web site that will tell you the volume of an object in cubic millimeters if you were to print it. The above object, for example, would have a volume of 7458 cubic mm. Our task today is to remove parts of the object while preserving the front, back, top and bottom connections and with the goal of reducing the volume dramatically.

Turn off the grid function before starting. That will help you line up pieces by hand better.

For example, I created a hole rectangular box that was 8 mm tall and placed it inside the ANALY text such that it would remove a bunch of the insides of the letters, while leaving the front, back, top and bottoms unchanged:



When I group those parts and check the new volume of the object, it was lowered to 1800 cubic mm. That's a huge reduction (from nearly 7500 down to 1800 in one move!). See the resulting object on the next page.



I knocked off more volume by cutting slots out of the fronts and backs of the letters (again, using hole pieces. This brought the volume down to about 1600. Here is the shape at this point:



I cut another 40 cubic mm off by making holes in the tops and bottoms of the letters:



I know I could have gone farther (I could have added more holes to the tops and bottoms, for example, I could have made the slots in the fronts and backs of the letters wider, etc.)

The assignment today is clearly detailed on the next page.

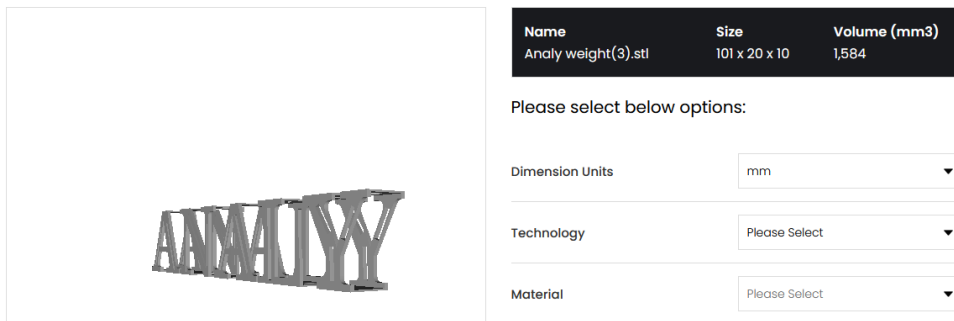
Steps:

1. Use the text tool and write "ANALY" in all caps in the default font. Leave it at the default size (approximately 101 x 20 x 10).
2. Use at least 10 hole objects to reduce the volume of the word. Do not completely remove the fronts, backs, tops and bottoms of the letters. Each letter must have some bit of front, back, top and bottom all continuously connected by material. Please do not change the overall size of the text "ANALY". Obviously if you just made the object smaller it would have a smaller volume; the goal today is to make the volume smaller using hole objects while keeping the outer dimensions constant.
3. When you want to test your results, export your project to an STL file.
4. Go to this web site: <https://www.think3d.in/landing-pages/3d-model-price-calculator/> and upload the STL file you just created. The site will show you the current volume of your creation. For example, here is what it looks like for mine:

Name	Size	Volume (mm3)
Analy weight(3).stl	101 x 20 x 10	1,584

5. Can you beat my record of 1584? Note the size of my object as shown below: (101 x 20 x 10) that is the size yours should be. (It is the default size of the word "ANALY" in the default font in Tinkercad.)
6. Try taking out more pieces. Remember, the requirement is that you use at least 10 hole pieces grouped into ANALY to reduce the volume. To get 100% on today's assignment you must do better than I did. One student 5th period 2023 got it down to below 18! (That's not a typo, he got it nearly 99% below what I did!)

When you are done, take a screen shot showing your object and its volume. Mine looks like this:



To take a screen shot on Windows 10, type Shift-Window+Key-S, then drag over the part of the window you want to capture. Then click on the window that appears and type Control-S to save the screen shot. **Save it with your name and "3D volume"**. Turn in the screen shot for credit.