10C Mountains and Earth's Crust

How can mountains float?

Solid objects float if they are less dense than the liquid in which they are placed. Objects sink if they are more dense than the liquid. You may have noticed that large ships are often made of steel. Ships made of steel float in water, even though steel is much more dense than water. Mountains, embedded in the continental crust, float in the upper mantle of the Earth. So how does a steel boat or a mountain float? The answer is in the concept of ***apparent density***. You will soon discover how and why boats can be made of materials that are denser than water, and how a giant mountain can float.

Materials

- Displacement tank
- Balance
- Disposable cup
- Beakers
- Graduated cylinder
- GeoBox
- Buoyancy blocks
- Metric ruler

Unlike steel, concrete or clay, Earth's crust is not shaped like a boat. For the most part it is solid, without a hollowed out section like the boat you made, and yet it floats. Beneath Earth's crust is the mantle. The mantle is made of very hot rock.

1 Why Earth's crust floats

a. There are two types of Earth's crust; continental and oceanic. Oceanic crust is on average about 15% more dense than continental crust. How do you think the difference in density would affect how both types of crust float on the mantle?

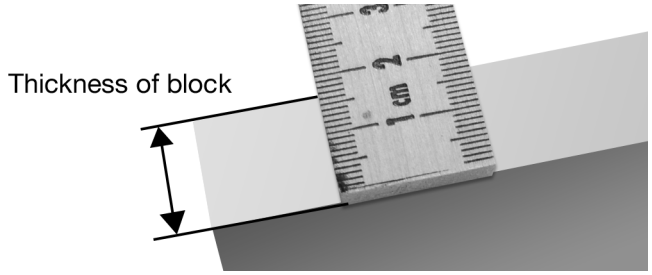
b. What kinds of things would make part of Earth's crust thicker than another part?

c. Continental crust is usually much thicker than oceanic crust. Make a prediction; Would being thicker affect how continental crust floats on the mantle compared to oceanic crust? If so, how?

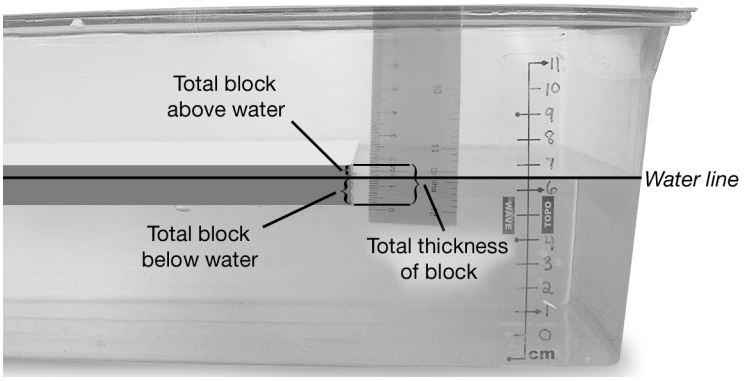
2 Testing your prediction

As mountains and mountain chains grow, the part of the crust they are on gets thicker and thicker. We are going to test your prediction of how getting thicker affects how the crust floats on the mantle by watching what happens when we build a mountain.

1. Fill the GeoBox with water up to the 5 cm line.
2. Measure the thickness of the largest mountain block and record your measurement in Table 1.



3. Place the largest mountain block in the water. This block represents Earth's continental crust.
4. Measure how much of the block is above the surface of the water, and how much is below the surface of the water. Record your measurements in Table 1.



5. Measure the thickness of the second largest mountain block. Record your measurement in Table 1. Add this measurement to the thickness of the first block and record the total thickness of all blocks in Table 1.
6. Its time to start building your mountain. Place the second largest block on top of the block in the water. There are guide lines painted on each block. Align the corners of the smaller block with the guide lines on the larger block as you stack them up. This helps keep the entire stack balanced as it floats. When you add a block to the stack, align its corners with the guide lines painted on the block on top of the stack.
7. Measure the total amount of both blocks above the surface of the water, and the total amount of both blocks below the surface.
8. Repeat steps 5–7 until you've measured all the blocks and completed the mountain.

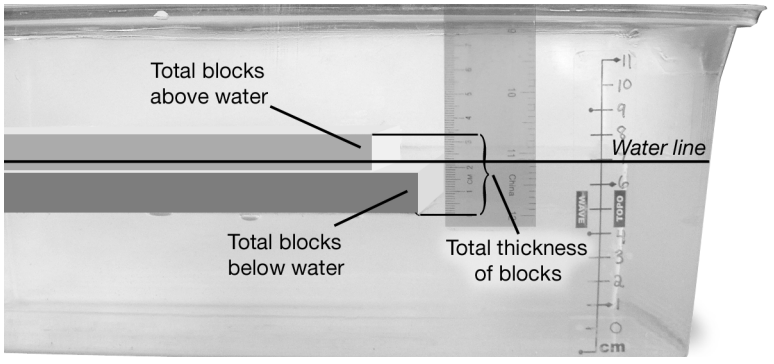


Table 1: Mountain blocks data

Block	Thickness (mm)	Total thickness of all blocks (mm)	Total amount above water (mm)	Total amount below water (mm)
first				
second				
third				
fourth				
fifth				

3 Thinking about what you observed

a. As the mountain grew taller, did the increase in height equal the thickness of each block you put on?

b. What happened to the total amount of all blocks underwater as the mountain grew taller?

c. Did the total amount underwater increase steadily as the mountain grew taller? Why or why not?

d. How does this activity relate to Earth's crust and mountain building?