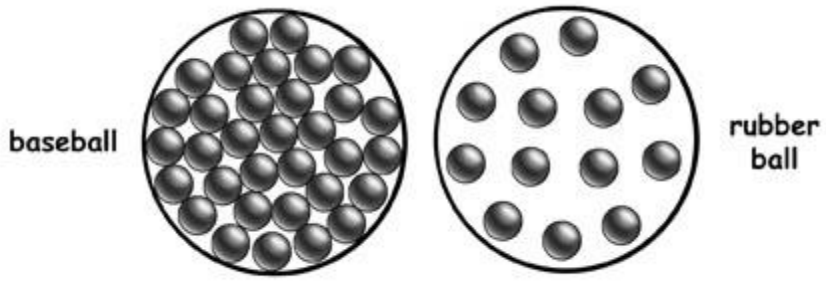
DENSITY NOTES

<u>Density</u> is a measure of the amount of matter in a certain amount of space.

Other ways to explain it: **<u>Density</u> is…**

- ✓ A measure of the amount of mass per volume
- ✓ A measure of how tightly or loosely packed the atoms or molecules are in matter



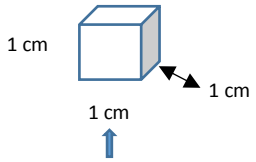
A baseball is denser than a rubber ball because there are more molecules per unit volume in a baseball than there are in a rubber ball. In other words, the baseball's molecules are packed more tightly than the rubber ball.

- ✓ **Density is a property of a substance that stays the same (at the same temperature) regardless of the size of the object or the amount**. For instance, a piece of pure gold has a density of 19.3 g/cm^3 regardless of the size of the piece of pure gold because the arrangement of the atoms is the same in all pure gold.

- ✓ If you **<u>heat</u>** the gold, the molecules will spread out, making the piece of gold larger while the mass stays the same. If the volume increases and the mass stays the same, what will happen to the density of the matter as you **<u>heat</u>** it? Explain._____
- ✓ What will happen to the density of matter as you **<u>remove heat</u>** or **<u>cool</u>** it? Explain_____
_____

- ✓ **<u>Liquids</u>** also have certain densities at certain temperatures regardless of the amount of the liquid. For instance, water has a density of 1.0 g/mL at room temperature. If you have 50 mL of water, it has a density of 1.0 g/mL. If you have 100 mL of water, it also has a density of 1.0 g/mL. But, if you **<u>heat</u>** the water, it will become slightly less dense because the molecules spread out, which increases the volume of the water. If you **<u>cool</u>** the water, it will become slightly denser because the molecules move closer to one another, decreasing the volume.

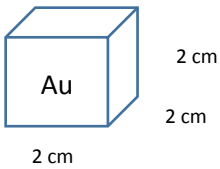
- ✓ **You can calculate the density of an object or substance by using the <u>formula</u>:**
  - **Density = mass/volume**
- ✓ **When calculating density, use the steps: <u>FORMULA, PLUG, CHUG</u> to show your work.**
- ✓ **Examples:**



<u>Mass</u> on balance was 19.3 grams

<u>Cube of Gold (Au)</u>

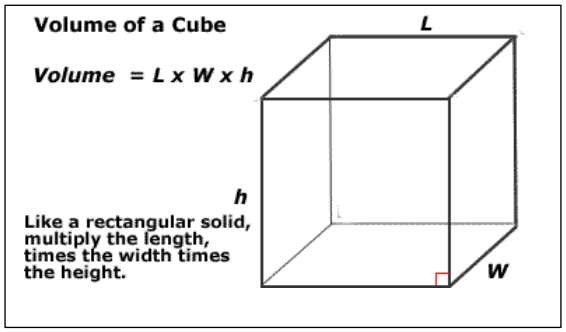
(Formula)	**V = L x W x H**	**D = m/v**
(Plug)	V = 1 cm x 1 cm x 1 cm	D = 19.3 g/1cm^3
(Chug)	**V = 1 cm^3**	**D = 19.3 g/cm^3**

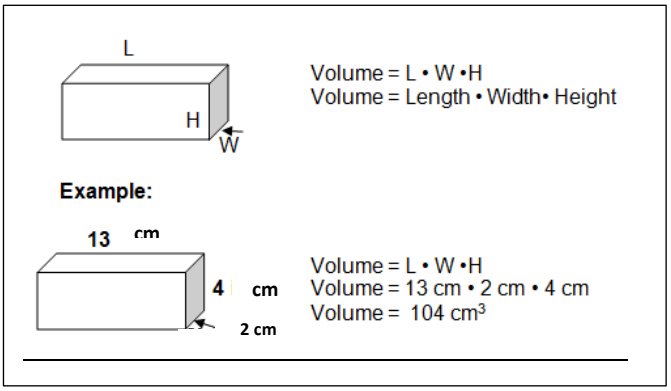


<u>Mass</u> on balance was 154.4 grams.

	V = L x W x H	**D = m/v**
	V = 2 cm x 2 cm x 2 cm	D = 154.4 grams/8 cm^3
	V = 8 cm^3	**D = 19.3 g/cm^3**

- ✓ To find the **density** of an object in the lab, you have to find out two things about the object. You have to find the _____of the object and the _____ of the object.
- ✓ To find the _____of the object, place it on a **triple beam balance** and record your answer in **grams**.
- ✓ There are several ways to find the **volume** of the object, depending on the **shape** of the object.
  - If the object is **regular** in shape (cube-like):
    - measure the length, width and height of the object and use the formula: **V = L x W x H**





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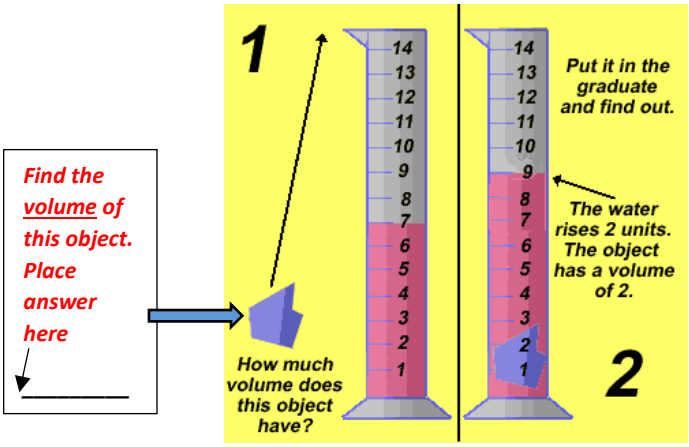
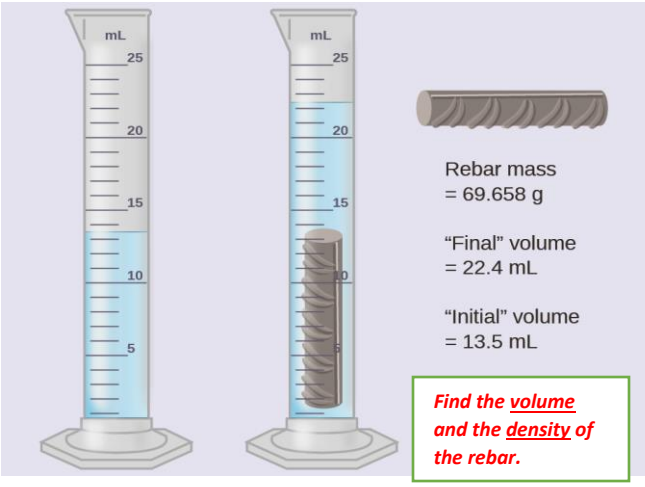
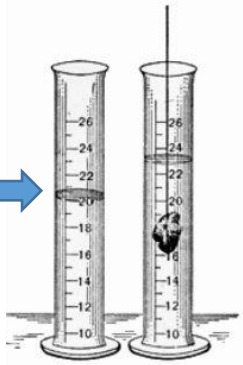
  - If the object has an **irregular shape** (can't accurately measure the length, width or height):
    - You have to **submerge (sink)** the object in either a **graduated cylinder** or an **overflow can** and measure the amount of water it **displaces** (or pushes out of the way) to find the **volume** of the object.
    - The amount of water that the object **displaces** (or pushes out of the way) when the object is **sunk,** is **equal** to the object's **volume**. **Remember that 1 mL = 1cm³**





If the object **floats**, you have to gently push the **object under the water** to find the **displacement** and the **volume** of the object.



If the object **does not fit in the graduated cylinder,** use the **overflow can** to find the amount of water the object displaces when submerged.