DO NOW
LABEL LEFT AND RIGHT PAGES
“PROPERTIES OF MATTER: DENSITY”
What was the independent (test) variable?
What was the dependent (outcome) variable?
Which trial was solid, liquid, gas? Explain.
What errors were present in this model?
How could those errors be resolved in future testing?
Mass Vs. Weight

On Earth:

- Mass = 120 kg
- Weight = 120 x 10 = 1200 N

On the Moon:

- Mass = 120 kg
- Weight = 200 N

The Planets:

- **Mercury**: Your weight is 52.9
- **Venus**: Your weight is 126.9
- **The Moon**: Your weight is 23.2
- **Mars**: Your weight is 52.7
- **Jupiter**: Your weight is 330.9
- **Saturn**: Your weight is 145.9
- **Uranus**: Your weight is 124.4
- **Neptune**: Your weight is 137.5
Physical Science...

When someone uses the word 'weight' instead of 'mass'.
Mass

- The MASS of an object is a measure of how much matter it contains.
- Even when an object is out in space, it still has mass, even though it does not have weight due to a lack of gravity.

Quick Check:

Which object has more mass:

the ping pong ball or the golf ball? EXPLAIN.
Measuring Mass (Massing)

• Measured in GRAMS (milligram, kilogram, etc.)
• Measured using a triple beam balance (below).
Weight

• An object’s weight is based on the amount of gravity pulling on it.

• Weight *can change* depending on what planet you are on.
Measuring Weight (Weighing)

• Measured in Newtons, pounds are most common.
• Measured using a spring scale (below) or digital scale.
One Sentence Summary

Mass measures the _________________________________ of a substance, while WEIGHT measures the amount of _________________________________ on a substance.
MEASURING MATTER: DENSITY
**Definition**

A measure of the matter (mass) inside a certain volume.

**DENSITY**

**What You are Measuring?**

<table>
<thead>
<tr>
<th></th>
<th>Possible Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (m)</td>
<td>g, kg</td>
</tr>
<tr>
<td>Volume (V)</td>
<td>mL, cm³</td>
</tr>
<tr>
<td>Density (D)</td>
<td>( \frac{g}{mL} ), ( \frac{g}{cm^3} )</td>
</tr>
</tbody>
</table>

**Units**
PHYSICAL PROPERTIES OF MATTER SUCH AS DENSITY...

DO NOT CHANGE!!
DENSITY DOES NOT CHANGE:
The density of gold is 19.30 g/cm³
So, whether you have a gold brick or a gold coin, the density of the gold is....

...19.30 g/cm³!!
Sample SSA Question

The table shows some properties of four different substances. The picture shows a solid sphere of one of the four substances in a water-ethanol solution, which has a density of 0.9199g/mL. The sphere is more likely composed of which substance?

a) Substance Q
b) Substance R
c) Substance S
d) Substance T
We are trying to find density!

\[
D = \frac{562 \text{ g}}{44.9 \text{ mL}} = 12.16 \text{ g/mL}
\]
A box is determined to have a mass of 15.50g. Its dimensions are determined to be 2.4cm x 5.6cm x 6.70cm. What is the density of this box? Would this box float in water?

We are trying to find density, but first we need to calculate volume!

The box will float because its density is less than the density of water.
What is the density of 48 g of a metal if the metal raises the level of water in a graduated cylinder from 25 mL to 33 mL?
SOLUTION

Volume (mL) of water displaced

\[= 33 \text{ mL} - 25 \text{ mL} = 8 \text{ mL}\]

\[D = \frac{\text{mass}}{\text{volume}} = \frac{48 \text{ g}}{8 \text{ mL}} = 6 \text{ g/mL}\]
Gabriel is testing the properties of four brands of golf balls. He places them in graduated cylinders containing 100 milliliters (mL) of water and determines that each ball has a volume of 20 cubic centimeters (cm³). He places the balls on a balance and finds that each has a different mass measured in grams (g). The properties of the golf balls are shown in the chart below.

Gabriel uses these numbers to find the density of the golf balls. Water has a density of 1.0 g/cm³. Which ball will float? (D = m/V)

<table>
<thead>
<tr>
<th>Ball</th>
<th>Mass (g)</th>
<th>Volume (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>33</td>
<td>20</td>
</tr>
</tbody>
</table>

a) A. Ball A  
b) B. Ball B  
c) C. Ball C  
d) D. Ball D
1. A rectangular block of copper has a mass of 1896 g. and is 8.4 cm long, 5.5 cm wide and 4.6 cm high. What is the density of the block of copper?

2. A 285 g piece of iron is added to a graduated cylinder containing 45.50 mL of water. The water level rises to 49.10 mL. Calculate the density of the iron.
LIQUID LAYERS – CHECK IT OUT!

- Which liquid has the highest density?
- Which liquid has the lowest density?
- Which liquid has the middle density?

Can you tell the density of something by looking at it?
DENSITY

• The density of a substance does not change! If you were to break a ruler in half, BOTH pieces will have the same density as the original ruler.