***Density***

***Directions:*** *Read the following paragraph about density. As you read, highlight or underline important concepts.*

Take a look at the two boxes below. Each box has the same volume. ***If each ball has the same volume, which box would have more mass? Why?*** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . *The box that has more balls (left) has more mass per unit of volume. This property of matter is called density. The density of a material helps to distinguish it from other materials. Since mass is usually expressed in grams and volume in cubic centimeters, density is expressed in grams/cubic centimeter.*

**We can calculate density using the formula: Density= Mass/Volume**

***You can calculate the mass of an object using a triple beam balance or an electronic scale. You can calculate the volume of a regular shaped solid using the formula V = l x w x h and if it is an irregular shaped solid use the water displacement method. Volumes of liquids can be measured in a graduated cylinder or a beaker*.**

**When referring to the density of a solid we use g/cm3 or kg/m3. When referring to the density of a liquid we use g/mL or kg/L.**

**The density of water is said to be 1g/mL. If something is less dense than water it will float and if it is denser than water it will sink.**

**Practice Problems:**

**Sample problem: What is the density of a billiard ball that has a volume of 100 cm³ and a mass of 250 g? D= 250 g ÷ 100 cm³ = 2.5 g/cm³**

|  |
| --- |
| 1. A loaf of bread has a volume of 2270 cm³and a mass of 454 g. What is the density of the bread? **Please show your work.** |
| 2. A liter of water has a mass of 1000g. What is the density of the water? (HINT: 1 mL= 1 cm ³) **Please show your work.** |
| 3. A block of wood has a density of 0.6 g/cm³ and a volume of 1.2 cm³ What is the mass of the block of wood? **Please show your work.** |

|  |  |
| --- | --- |
| **Substance** | **Density (g/cm³)** |
| Gold | 19.3 |
| Mercury | 13.5 |
| Lead | 11.4 |
| Iron | 7.87 |
| Aluminum | 3.7 |
| Bone | 1.7-2.0 |
| Gasoline | 0.66-0.69 |
| Air (dry) | 0.00119 |

4. *Use the data below to calculate the density of each unknown substance. Then use the density chart on the right to determine the identity of each substance.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mass (G) | Volume (cm3) | Density (g/cm3)(Show work) | Substance Name |
| A | 171 | 15 |  |  |
| B | 148 | 40 |  |  |
| C | 475 | 250 |  |  |
| D | 680 | 1000 |  |  |

A Matter of Density

*Imagine that you work at a chemical plant. This morning, four different liquid chemicals accidentally spilled into the same tank. Luckily, none of the liquids reacted with each other! Also, you know the liquids do not dissolve in one another, so they must have settled in the tank in four separate layers. The sides of the tank are made of steel, so you can only see the surface of the inside. But you need to remove the red chemical to use in a reaction later this afternoon. How will you find and remove the red chemical? By finding the chemical’s different densities, of course!*

The following liquids were spilled into the tank:

* a green liquid that has a volume of 48 L and a mass of 36 kg
* a blue liquid that has a volume of 144 L and a mass of 129.6 kg
* a red liquid that has a volume of 96 L and a mass of 115.2 kg
* a Black liquid that has a volume of 120 L and a mass of 96 kg

 1. Calculate the density of each liquid.

 Green \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Red \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Blue \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Black \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Determine the order in which the liquids have settled in the tank.

 First (bottom) \_\_\_\_\_\_\_\_\_\_\_\_\_ Third \_\_\_\_\_\_\_\_\_\_\_\_\_

 Second \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Fourth(top) \_\_\_\_\_\_\_\_\_\_\_

3. Use colored pencils to sketch the liquid layers in the container in the diagram at the bottom of the page.



4. Now that you know where the red chemical is inside the tank, how can you remove it?