NS 5.4 (pg 1 of 2) **Derived Units: Area & Volume**
Compound Units: something per something Name_____

Area – squared units^2

1. Imagine you had a piece of paper 2 dm on each side, and calculate the size of that piece of paper.
   - In other words, calculate its area?

2. A decimeter is about this long: _____
   - At the front, observe how many squares decimeters are inside a 2 dm by 2 dm square. Do you see a connection between the number of squares and the calculated area in # 1 ?

3. Using what you know about metric prefixes, convert 4 dm^2 to cm^2 _____

4. You know that 1 dm = 10 cm. On the overhead, observe the 2 dm × 2 dm square that now has the centimeter (cm) increments marked off. When each cm mark on opposite sides of the square is connected we can count how many cm squares are inside the 20 cm by 20 cm square. Do you see a connection between the number of squares and the area converted in # 3 ?

SUMMARY: This is meant to show you that when a metric unit is a squared unit (m^2) you determine the number of places that the decimal should be moved based on the prefix change and then double (not square) that amount. This happens because the decimal moves one place on the length and one place on the width, for a total of two units. (For cubed units m^3, determine the number of places the decimal should move based on the prefix change, and then triple (not cube) that amount.)

Volume – cubed units^3

5. Imagine that you have a box that is 1 dm on each of its 3 sides. Calculate the volume of space this cube takes up. In other words, how big is it?

6. Knowing what you now know about metric prefixes and derived units, convert 1 dm^3 to cm^3 _____

7. Check out the box that built that is 10 cm on each side. Observe how many little cubes would be inside the 10 cm by 10 cm by 10 cm box. Is there a connection between the number of small cubes and the volume that you calculated in # 9 ?

SUMMARY: As with area units, when using cubed units the decimal moves three places not just one because the decimal moves one place on the length and one place on the width, and one place on the height for a total of three units. For cubed units, determine the number of places the decimal should move based on the prefix change, and then triple (not cube) that amount.

8. One Liter is defined as one dm^3. Since 1 L = 1000 ml, and 1 dm^3 contains 1000 tiny cubic centimeters, this must mean that 1 cm^3 = 1 ml. Use your playdoh and ruler to make one tiny cube 1 cm × 1 cm × 1 cm = 1 cm^3. Then gently roll your cubic centimeter into a cylinder shape and hold it up (do not put it in) to the 10 ml cylinder to observe that indeed 1 ml = 1 cm^3.

Memorize: by definition: 1 ml = 1 cm^3. We will use these units interchangeably.

Conversions for Compound & Derived Units

Dealing with conversion of compound cubed or squared units such as cm^3 or m^2

- What if we want to convert 0.00036 km^2 to m^2
  - ✓ This is an area unit, meaning a length and a width so the decimal place change is twice the number of decimal places you would otherwise expect.
  - ✓ We are moving from a larger to smaller unit, so the number gets larger.
  - ✓ Since km to m is a 3 decimal place move
  - ✓ but it is a 3 decimal place move on the length *and* the width for a total of 6 decimal places to move.
  - ✓ thus 0.00036 km^2 = 360 m^2
- Or when you go to physics with Ms Johnson, she will suggest that you convert this way (I like this way too):

$$0.00036 km^2 \left(\frac{1000m}{1km}\right)\left(\frac{1000m}{1km}\right) = 360 km^2$$

Dealing with conversion of compound units such as grams per ml (g/ml) or miles per hour (mi/hr)

- The density of air is 0.00129 g/ml and we want to convert to g/L
  - ✓ First think about its meaning. If 0.00129 grams fit in 1 ml, how many grams will be able to fit in 1 L? Many more....
    - ➢ so don't make the mistake of moving the decimal the wrong way.

Solution

- We don't usually write a number in the denominator of the units because it is understood to be a 1
  - ✓ thus 0.00129 g/ml means the same as $\left(\frac{0.00129g}{1ml}\right)$
- To make the conversion, you may be more successful showing the conversion factor and making sure your units cancel out correctly
  - ✓ $\left(\frac{0.00129g}{1ml}\right)\left(\frac{1000ml}{1L}\right) = 1.29 g/L$