Unit Conversion Problem Practice Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part of the AP exam and exams you will take for me is a math problem. The problem does not allow you to use a calculator. This means that the math operations are simple enough to do by hand. HOWEVER, many people who have grown up being calculator dependent struggle with this immensely. So, time to go back to basics!

Most of the problems you will encounter will ask you to convert from one unit to another. This may require many steps. This seems overwhelming. However, it is not, if you know how to properly set up the problem.

There are no hard 100% solid rules to solving these. However, the best piece of advice I can offer is this:

**WORK WITH THE UNITS FIRST. THEN WORK WITH THE NUMBERS LAST!!!!**

The units are FAR more important. Set those up first. They guide you through the rest of the problem.

EXAMPLE PROBLEM: Here is a problem that might be seen and then a proper set up of the problem:

You are working with a household cleaner that is toxic if consumed in a large enough dose. Because you have not been paying attention, a child in your care has consumed the 500 mL bottle of the chemical. It has a toxicity rating of 25 mL / 1 kg of body mass. At what weight (in lbs) would a child need to have at minimum in order to avoid a severe toxicity reaction? (1 kg = 2.2 lbs)

Step 1: Identify the starting value of the problem.

* In this problem, the problem revolves around a household cleaner that was consumed. The value that starts this is the 500 mL consumed.

Step 2: Identify the ending value of the problem.

* The problem wants you to solve the weight in lbs. of a child. So, the unit of your answer is lbs.

Step 3: Set up the start and end and fill in the units in between to get from start to end. NO NUMBERS!!

500 mL x \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = lbs

(In order to convert from unit to unit, you multiply your starting number by fractions.)

Step 4: Fill in the fractions with units. If you start with mL, then to get out of mL you put it in the opposite position of the next fraction. In this problem, since mL starts on the top, then you put it in the bottom of the following fraction. Then you fill in the other part of the fraction with a unit you can convert into, based on the other information given in the problem:

500 mL x kg x \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = lbs

mL

500 mL x kg x lb = lbs

mL kg

(NOTICE – no numbers have gone into the fractions…just units in opposite places! Remember, the problem gave me a conversion for kg to mL and also gave me one for lb to kg. The last unit left is the unit I want. So I am done and can stop setting up fractions)

Step 5: Now fill in the numbers that go with the conversions.

500 mL x 1 kg x 2.2 lb = lbs

25 mL 1 kg

Step 6: Any numbers on the top of the fractions get multiplied together. Then divide that answer by any numbers on the bottom of the fractions. Now you have the answer.

500 mL x 1 kg x 2.2 lb = 1100/25 = 44 lbs

25 mL 1 kg

[Units in opposite places in these fractions cancel out. So mL are set up in opposite places…they cancel. The kg also are set up that way. They cancel. All that is left is lb]

PRACTICE PROBLEMS:

OK….now you get to try. Please set up the conversion like I have shown, even if you don’t have to and understand how to do it otherwise. You will get the chance later to do other ways. However, this assignment requires that you show all the steps, then show the final answer!

#1) Your community is installing a windmill to supplement its energy needs. It is rated to produce 6 MW (megawatts). How many homes can this supply energy for if an average home uses 1200 W? (1 MW = 1000000 W)

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer:

#2) The BP oil spill in the Gulf of Mexico took 90 days in length. It is estimated that the spill released 50,000 barrels of oil/day. How many gallons was spilled into the Gulf in total during this time? (1 barrel = 42 gallons)

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer:

#3) You own a farm with 400 cows. You grow corn to feed the cows. An average cow eats 25 kg of corn each day. How much corn do you need to grow to feed all the cows on the farm for a day? Then calculate how much corn you need for the year for all cows. (You feed corn to the cows for 300 days/year, while you feed them other things during the rest of the year).

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer:

#4) Most energy used in the U.S. is produced from coal. There are 300,000,000 people in the U.S. It is estimated that one person is responsible for the burning of 1 ton of coal per year to do what they do in their daily life. For every 100 lbs of coal burned, 2.5 lbs of sulfur go into the atmosphere. How much sulfur is put into the air by coal burning each year for all the people in the U.S.? [1 ton = 2000 lb]

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer:

#5) Your family uses a hot water heater to heat water for showers. It uses 0.2 kWh of energy/gallon of water used (kWh stands for kilowatt-hour, which is the way the electric company measures your energy use). The cost of a kWh is $0.10/kWh. Your family uses 30000 gallons of hot water per year for showers. How much money will you spend on electric energy to heat the water for your family showers for a DAY? (You do not use the hot water heater each day of the year. So, only calculate for 300 days in the year).

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer:

6) Your community has a landfill to place its trash. The landfill will fill with rain water over the year which collects toxic materials from the trash. Then the water will try to drain down into the soil, taking the toxic materials with it into the ground and groundwater. In order to prevent this contamination, the landfill is designed to catch this drainage water and treat it to remove the toxins.

Your landfill collects 900 m3 of rain water each year. As that water goes down through the landfill, it collects a toxic metal called cadmium at a concentration of 2 g/m3 of water. The cost of filtering the cadmium out of the water for the community is $5000/kg of cadmium removed. How much money does your community need to spend on cadmium removal of landfill water each year? (Remember, 1 kg = 1000 g)

Show your set up of the problem, WITHOUT numbers in the conversion:

Now fill in the numbers and compute the final answer: