Changing Units
Remediation Worksheet

To express a measurement in different units the rule is you always multiply. The question becomes, " What goes on the top of the fraction and what goes on the bottom of the fraction you are multiplying by?"

Here are some time and distance equalities. These can be used when changing units, but they first need to be written as conversion factors...the fractions you multiply by.

<u>times and distances</u>
1 year = 52 weeks,   1 week = 7 days,   1 day = 24 hours,   1 hour = 60 minutes
1 minute = 60 seconds,   1 kilometre(km) = 1000 metres(m),   1 m = 100 cm,
1 cm = 10 mm   1 mile = 5280 ft,   1 ft = 12 in,   1 mile = 1.61 km

We can change these equalities to represent fractions with a value of 1. These fractions with a value of one are the conversion factors that we need to use when changing units. One set of conversion factors has been created below:

$$1 \text{ day} = 24 \text{ hours}$$

#1 $$\frac{1 day}{1 day} = \frac{24 hours}{1 day}$$

$$1 = \frac{24 hours}{1 day}$$

$$1 \text{ day} = 24 \text{ hours}$$

#2 $$\frac{1 day}{24 hours} = \frac{24 hours}{24 hours}$$

$$\frac{1 day}{24 hours} = 1$$

So, when changing from days to hours, you will need to multiply by the first conversion factor. When changing from hours to days you will need to multiply by the second conversion factor. Remember, the units you want to change must divide out ("cancel"). You should be left with the units you want.

Here's an example:
Convert 14400 seconds to hours.

1. Write a conversion factor to change seconds to minutes.

2. Write a conversion factor to change minutes to hours.

3. Now, divide out, "cancel", the identical units which appear above and below the fraction line.

Notice, 14400 s is the same as $\frac{14400 s}{1}$.

$$\frac{14400 s}{1} \times \frac{1 min}{60 s} \times \frac{1h}{60 min} = \frac{14400 h}{3600}$$

$$= 4h$$

4. To finish, simplify the answer you get from multiplying.

Here's another example, but this one involves changing the units of a rate. You need to change the units in the numerator and the denominator.

Convert 240 km per hour to metres per second.

First write a conversion factor to change kilometers to meters.

Then write two conversion factors to change hours to minutes then minutes to seconds.

$$\frac{240\,km}{h} \times \frac{1000\,m}{1\,km} \times \frac{1h}{60\,min} \times \frac{1\,min}{60\,s}$$

All the units you don't want must divide out. All the units you do want must be on the proper side of the fraction line.

$$= \frac{240\,km}{h} \times \frac{1000m}{1\,km} \times \frac{1h}{60\,min} \times \frac{1\,min}{60\,s}$$

Multiply all the numerators together and multiply all the denominators together.

$$= \frac{240000m}{3600s}$$

$$= \frac{66.67m}{s}$$

Divide the resulting numerator by the resulting denominator.

Thus $\quad \dfrac{240\,km}{h} = \dfrac{66.67m}{s}$

Solve the following and show all work.

1. Complete the following changes of units and include the conversion factors.

a) Convert 30 hours to seconds.

b) Convert 0.0003 days to seconds

c) Convert 72 000 seconds to hours

d) Convert 108 000 minutes to days

e) Convert 90000 centimetres to kilometers

f) Convert 97 kilometres to metres

g) Convert 100 kilometres to miles

h) Convert 100 kilometres per hour to metres per second

i) Convert 100 meters per second to kilometres per hour

2. Determine the number of cubic centimeters in 2.4 cubic kilometers. First write down the necessary equalities...it will help to draw pictures here. Then write your solution using conversion factors. Draw a picture to help with this units conversion.