How the metric system works.
The figure to the right shows the prefixes which are used in the metric system. Standard units used in association with these are the gram, liter, and meter. They are combined, as shown in the table below.

<table>
<thead>
<tr>
<th>gram (g)</th>
<th>liter (l)</th>
<th>meter (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>milligram</td>
<td>milliliter</td>
<td>millimeter</td>
</tr>
<tr>
<td>centigram</td>
<td>centiliter</td>
<td>centimeter</td>
</tr>
<tr>
<td>decigram</td>
<td>deciliter</td>
<td>decimeter</td>
</tr>
<tr>
<td>gram</td>
<td>liter</td>
<td>meter</td>
</tr>
<tr>
<td>Decagram</td>
<td>Decalitre</td>
<td>Decameter</td>
</tr>
<tr>
<td>hectogram</td>
<td>hectoliter</td>
<td>hectometer</td>
</tr>
<tr>
<td>kilogram</td>
<td>kiloliter</td>
<td>kilometer</td>
</tr>
</tbody>
</table>

Each level on the chart/table increases in size by a factor of 10 going downwards. There are 10 milligrams in 1 centigram and 10 liters in 1 Decaliter. When going upwards, each measure is one tenth the size of the preceding one. A hectometer is one tenth of a kilometer and a centiliter is one tenth a deciliter.

Activity 1: Circle the largest unit in each pairing.

a) millimeter centimeter
b) liter deciliter
c) hectogram kilogram
d) deciliter centiliter
e) Decameter meter
f) centigram decigram

We can change the units by multiplying or dividing by factors of ten for each change in level. If you change a single level, you multiply or divide by one factor of 10, which is 10. If you change two levels you multiply or divide by two factors of 10, which is 100 (10^2). Three levels means 3 factors of 10 (10^3 or 1000), four levels means 4 factors of 10 (10^4 or 10000).

If you measure a value, let’s say 67.5 grams, you can change it to any other gram unit, including milligrams, hectograms, and so on. For each level you change, you must multiply or divide the value by a factor of 10 as discussed above. Going from grams to milligrams, it makes sense that, because milligrams are a smaller unit, there will be more of them. Because they are 3 levels apart, we multiply by three factors of 10, or 1000. Therefore, there are 67500 milligrams in 67.5 grams. Hectograms are a larger unit than grams, by two factors of ten. So we divide 1000 by 100 and find that there are .675 hectograms in 67.5 grams.

Activity 2: Determine the new value for each change in units.

a) 16 mg = ______ g    b) 9 Dl = ______ kl    c) 0.02 dm = ______ mm
d) 300 mg = ______ g    e) 34.54 cm = ______ hm    f) 0.7 dl = ______ ml
g) 30 m = ______ km    h) 0.004 kg = ______ mg    i) 2,000,000 mm = ______ hm
j) 1.78 l = ______ cl   k) 25 dl = ______ Dl    l) 500 g = ______ cg
Homework:

1. Refer to the diagram on the front of the sheet. Indicate if the change is going up (↑) or going down (↓). The first one is done for you.
   a) from cm to Dm  ↓
   b) from g to mg
   c) from ml to dl
   d) from Dg to dg
   e) from mg to g
   f) from hm to dm
   g) mm to km
   h) from m to cm
   i) from cl to l

2. Refer to the questions in number 1 above. State how many steps each set changes. Stage also what factor of 10 that is. The first one is done for you.
   a) 3 steps (1000)
   b) _________________
   c) _________________
   d) _________________
   e) _________________
   f) _________________
   g) _________________
   h) _________________
   i) _________________

3. Determine the new value for each change in units.
   a) 30 mm = _______ m
   b) 45 g = _______ cg
   c) 0.09 km = _______ cm
   d) 200 dl = _______ Dl
   e) 21.9 mg = _______ g
   f) 3.7 dl = _______ cl
   g) 1200 m = _______ km
   h) 0.015 kg = _______ dg
   i) 2,000,000 ml = _______ kl
   j) 978 mm = _______ m
   k) 1.25 hg = _______ cg
   l) 0.5 g = _______ mg
   m) 0.0008 l = _______ ml
   n) 30,000 mg = _______ hg
   o) 12 kg = _______ dg

4. Determine what the missing units must be.
   a) 160 mg = 16 _______
   b) 12 g = 1200 _______
   c) 0.09 dm = 9 _______
   d) 356 dl = 0.356 _______
   e) 5 Dm = .05 _______
   f) 0.04 kl = 40 _______
   g) 10 m = 1000 _______
   h) 1.05 g = 1050 _______
   i) 75,000 cm = 0.75 _______
   j) 8 l = 0.08 _______
   k) 600 cl = 6 _______
   l) 900,000 mg = 9 _______
   m) 200 hl = 2000 _______
   n) 0.25 cg = 2.5 _______
   o) 100 mg = 0.01 _______

5. Add. Answer in a) grams, b) liters, and c) meters.
   a) 0.01 kg
   b) 2.3 Dl
   c) 0.01 km
   160 mg
   150 cl
   27 dm
   17 g
   800 ml
   1500 mm
   + 2 dg
   + 0.009 kl
   + .02 hm