Math Review

Fill in the following table for the quantities and their symbols:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>mass</td>
<td>Kilograms</td>
<td>kg</td>
</tr>
<tr>
<td>time</td>
<td>seconds</td>
<td>s</td>
</tr>
<tr>
<td>force</td>
<td>Newtons</td>
<td>N</td>
</tr>
<tr>
<td>energy</td>
<td>Joules</td>
<td>J</td>
</tr>
<tr>
<td>power</td>
<td>Watts</td>
<td>W</td>
</tr>
<tr>
<td>speed</td>
<td>m/s</td>
<td></td>
</tr>
<tr>
<td>frequency</td>
<td>Hertz</td>
<td>Hz</td>
</tr>
</tbody>
</table>

Complete the following conversions

1. 4 km = \( \frac{4000}{1 \text{ km}} \) m
2. 54 mm = \( \frac{54}{1 \text{ mm}} \) m
3. 0.394 Mg = \( \frac{394000}{1 \text{ Mg}} \) g
4. 4000 ms = \( \frac{4}{1 \text{ s}} \) s
5. 4 dl = \( \frac{4}{1 \text{ dl}} \) l
6. 70 dam (deka meters) = \( \frac{70}{1 \text{ dam}} \) m
7. \( \frac{4 \times 10^4}{1 \text{ cm}^3} \) cm³
8. \( \frac{900000 \mu m}{1 \text{ cm}} \) km
9. 4000 s = \( \frac{4000}{1 \text{ s}} \) h
10. 67 m² = \( \frac{670000}{1 \text{ cm}^2} \) cm²

Example 1:
\[
3000 \text{ cm} = \frac{3000}{1 \text{ m}} \times \frac{1 \text{ km}}{100 \text{ cm}} = 0.03 \text{ km}
\]

Example 2:
\[
3 \text{ m}^3 = \frac{3}{1 \text{ m}^3} \times \frac{1000 \text{ cm}^3}{1 \text{ cm}^3} = 3,000,000 \text{ cm}^3
\]

Rounding:

5 and up \( \rightarrow \) round up
4 and down \( \rightarrow \) round down

4.55 \( \rightarrow \) 4.6
4.54 \( \rightarrow \) 4.5

Significant Figures:

All non-zero numbers count.
Zeros to the left never count.
Zeros in the middle always count.
Zeros to the right count only if there is a decimal in the number.

Example: 0.0050600 This number has 5 sig figs because the four zeros to the left of the 5 don’t count.
The 5 and 6 count. The 0 in the middle counts. The two zeros to the right of the 6 count because there is a
decimal in the number.

Example: 567,000 This number has 3 sig figs because the 5,6, and 7 count, but the zeros to the right
do not count since there is no decimal in the number.

Round the following numbers to 2 sig figs:

1. 35.67 \( \rightarrow \) 36
2. 0.0004567 \( \rightarrow \) 0.0004
3. 2.34 \times 10^4 \( \rightarrow \) 2.3 \times 10^4
4. 4.777 \times 10^{-6} \( \rightarrow \) 4.8 \times 10^{-6}
5. 23.33 \( \rightarrow \) 23
6. 0.0102 \( \rightarrow \) 0.01
7. 9.99536 \( \rightarrow \) 1.0 \times 10^5
8. 1.0326 \( \rightarrow \) 1.0
9. 156.21 \( \rightarrow \) 160
10. 9.75 \( \rightarrow \) 10
**Multiplication / Division:** This is the most common rule for sig figs we will be using. Use this for all multiplication or multifunction equations. Use the **lowest number of total sig figs** in your equation for your answer.

*Example:* \(6.5 \text{ m} \times 687.3 \text{ m} = 4467.645 \text{ m}, \) but because of sig figs, your answer will be \(4.5 \times 10^3 \text{ m}\)

**Addition / Subtraction:** If you have a situation where you are only using addition and / or subtraction you should use this rule for sig figs. Look at the number of decimal places and use the smallest number of decimal places in your answer.

*Example:* \(3.456 \text{ s} + 22.55 \text{ s} = 26.006 \text{ s}, \) but because of sig figs, your answer will be \(26.01 \text{ s}\).

Solve the following equations and leave the answers with the correct number of sig figs:

1. \(23 + 4.8 = 27.8\)
2. \(234.67 \times 34 = 8.0 \times 10^3\)
3. \(4567 / 2.45 = 1880\)
4. \(2.56 + 0.89 = 3.45\)
5. \(2345.8 \times 23.2 = 54400\)

**Percent Uncertainty:**

If something is measured to be 12.3 cm +/- 0.5 cm. What is its percent uncertainty?

\[
\frac{0.5 \text{ cm}}{12.3 \text{ cm}} \times 100\% = 4\% \text{ uncertainty}
\]

It is important to know how big the uncertainty is compared to the actual measurement. 0.5 cm error would be a lot if your measurement was only 2.1 cm! That would amount to an error of 24% instead of only 4% \((0.5 / 2.1) \times 100\% = 24\%\)

To emphasize this point, consider this; 1 cm error when you are measuring 100 000 cm isn’t much, therefore almost negligible. Your calculated % error would be low. 1 cm error when you are measuring only 10 cm is a concern. Your % error would be much higher.

**Trigonometry:**

a) **Right Angle Triangles**

\[
sin \theta = \frac{a}{c} \\
cos \theta = \frac{b}{c} \\
tan \theta = \frac{a}{b}
\]

Pythagorean Theorem:

\[
c^2 = a^2 + b^2
\]

b) **Other Triangles**

Sine Law:

\[
\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}
\]

Cosine Law:

\[
c^2 = a^2 + b^2 - 2ab \cos C
\]