Dimensional Analysis

1. How many seconds are there in 5 minutes?

$$5\,\text{min} \times \frac{60\,\text{sec}}{1\,\text{min}} = 300\,\text{sec}$$

2. How many grams are in 3 kilograms?

$$3\,\text{Kg} \times \frac{1000\,\text{g}}{1\,\text{Kg}} = 3000\,\text{g}$$

3. How many metres are there in 12 kilometres?

$$12\,\text{Km} \times \frac{1000\,\text{m}}{1\,\text{Km}} = 12\,000\,\text{m}$$

4. How many milligrams are there in 22 kilograms?

$$22\,\text{kg} \times \frac{1000\,\text{g}}{1\,\text{Kg}} \times \frac{1000\,\text{mg}}{1\,\text{g}} = 22\,000\,000\,\text{mg}$$

5. How many centimetres are there in 6 kilometres?

$$6\,\text{Km} \times \frac{1000\,\text{m}}{1\,\text{Km}} \times \frac{100\,\text{cm}}{1\,\text{m}} = 600\,000\,\text{cm}$$

6. How many millilitres are there in 4 litres?

$$4\,\text{L} \times \frac{1000\,\text{mL}}{1\,\text{L}} = 4000\,\text{mL}$$

7. How many minutes are there in a year?

$$1\,\text{year} \times \frac{365.25\,\text{days}}{1\,\text{year}} \times \frac{24\,\text{hours}}{1\,\text{day}} \times \frac{60\,\text{min}}{1\,\text{hour}} = 525960\,\text{min}$$

8. There are 0.45kg in one pound. If a student has a mass of 120 lb, what is his mass in milligrams?

$$120\,\text{lb} \times \frac{0.45\,\text{kg}}{1\,\text{lb}} \times \frac{1000\,\text{mg}}{1\,\text{kg}} = 54\,000\,\text{mg}$$

9. There are 12 inches in a foot and there are 3.28 feet in one metre. Alex is 6ft, 2 inches tall. What is his height in metres?

$6\,\text{ft}\,2\,\text{inches} = 6 + \frac{2}{12} = 6.1666\,\text{ft}$

$$6.1666\,\text{ft} \times \frac{1\,\text{m}}{3.28\,\text{ft}} = 1.88\,\text{m}$$

10. Has one mole (6.02×10^{23}) of seconds gone by since the Bing Bang occurred 13.8 bya?

$$13.8\,\text{by} \times \frac{10^9\,\text{year}}{1\,\text{by}} \times \frac{365.25\,\text{day}}{1\,\text{year}} \times \frac{24\,\text{h}}{1\,\text{day}} \times \frac{60\,\text{min}}{1\,\text{h}} \times \frac{60\,\text{sec}}{1\,\text{min}}$$

$= 4.355 \times 10^{17}\,\text{sec}$ ⇒ no, $1\,\text{mole} = 6.02 \times 10^{23}$

$4.355 \times 10^{17} < 6.02 \times 10^{23}$