

$10^6$

Million

$10^9$

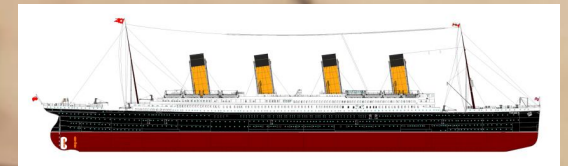
Billion

$10^{12}$

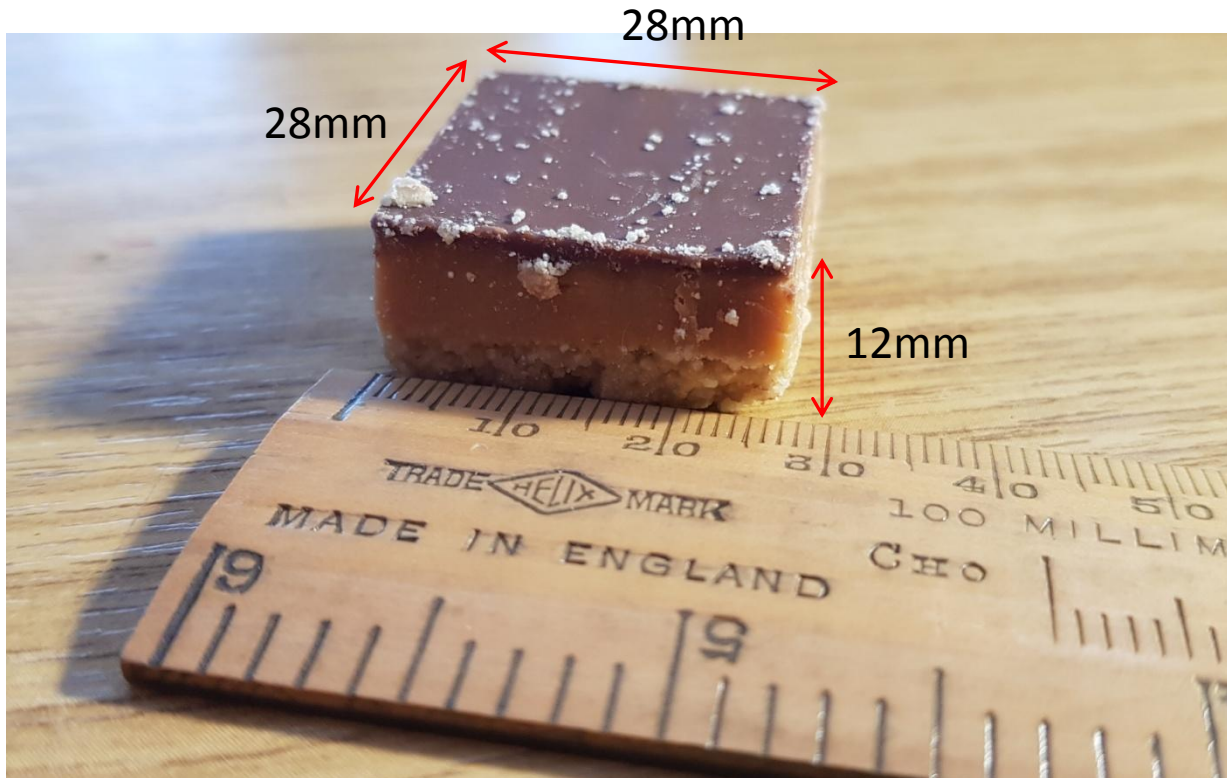
Trillion



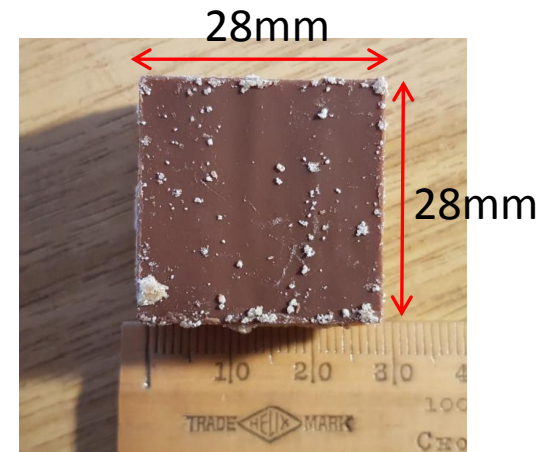
Andy French  
May 2023



Here is a millionaire's shortbread 'mini bite' from a supermarket



It has a square cross section of side length 28mm and it is 12mm thick.



A **million** is a thousand thousand:

$$1,000,000 = 1,000^2 = (10^3)^2 = 10^6 = (10^2)^3 = 100 \times 100 \times 100$$

So a million millionaire mini bites will be a stack of 100 wide by 100 deep by 100 high.

$$1\text{m} = 1,000\text{mm} \quad \therefore 1\text{mm} = \frac{1}{1,000} \text{m}$$

Convert mm  
to metres (m)

$$\therefore 28\text{mm} \times 100 = 28 \times \frac{1}{1,000} \text{m} \times 100 = 2.8\text{m}$$

$$\therefore 12\text{mm} \times 100 = 12 \times \frac{1}{1,000} \text{m} \times 100 = 1.2\text{m}$$

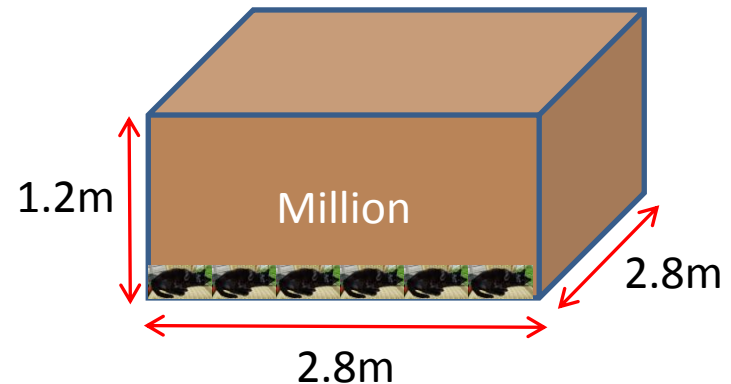
... So a **million mini-bites** will form a *cuboid* 2.8m wide, 2.8m deep and 1.2m high.



460mm

Sybil the cat is 460mm = 0.46m long. So **2.8m is just over 6 cats** and **1.2m is 2.6 cats**

$$\frac{2.8}{0.46} = 6.1 \quad \text{to 2.s.f}$$

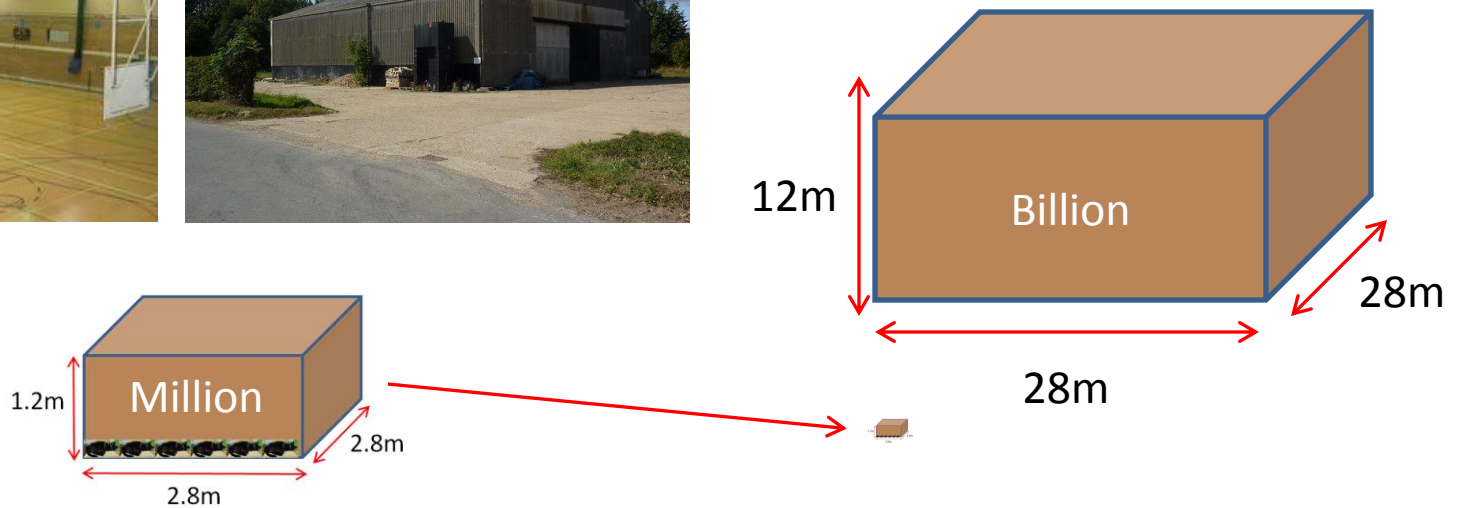


A **billion** is a **thousand million**:

$$1,000 \times 1,000,000 = 10^9 = (10^3)^3 = 1,000 \times 1,000 \times 1,000 \\ = (10 \times 100) \times (10 \times 100) \times (10 \times 100)$$

Which means a **billion mini-bites** form a cuboid which is **ten times larger in every dimension** than a million mini bites.

Which is about the volume size of a large sports hall or barn.



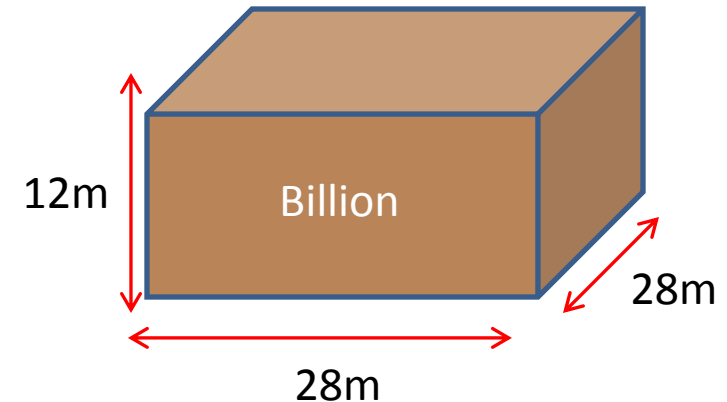


An **Olympic swimming pool** is 50m long, 25m wide and up to 3m deep.

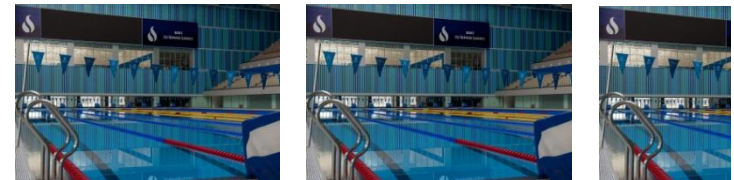
So a **billion mini-bites** is equivalent to

$$\frac{12\text{m} \times 28\text{m} \times 28\text{m}}{50\text{m} \times 25\text{m} \times 3\text{m}} = 2.51$$

Olympic swimming pools  
by volume



=

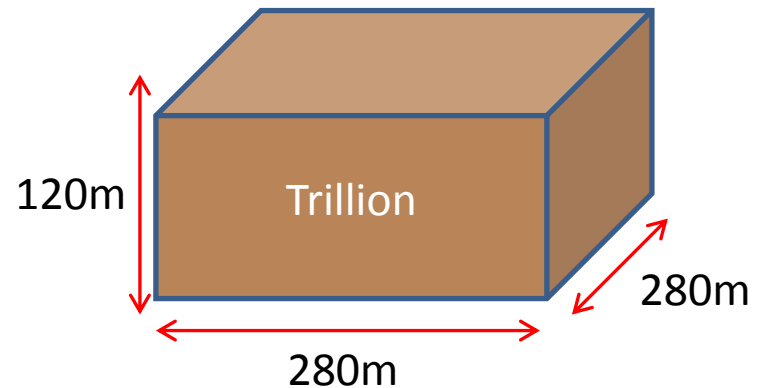
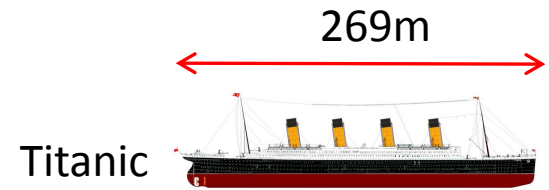


A **trillion** is a **thousand billion**:

$$1,000 \times 1,000,000,000 = 10^{12} = (10^4)^3 = 10,000 \times 10,000 \times 10,000 \\ = (10 \times 10 \times 100) \times (10 \times 10 \times 100) \times (10 \times 10 \times 100)$$

Which means a **trillion mini-bites** form a cuboid which is **ten times larger in every dimension** than a billion mini-bites.

The **Titanic** was 269m long, so would nearly form *one edge of the trillion mini-bite cross section*.



**What does a trillion pounds look like?** (Note the *Gross Domestic Product* (GDP) of the UK is about 2.2 trillion, and the total tax income to the UK is about 0.9 trillion per year). ← [2020-2021 figures](#)

A **£1 coin** has a volume of:

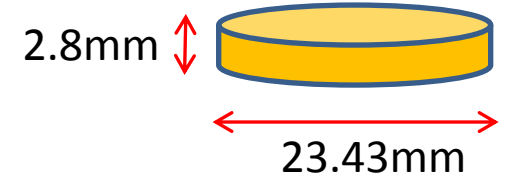
$$\begin{aligned} \pi \times \left(\frac{1}{2} \times 23.43\text{mm}\right)^2 \times 2.8\text{mm} &= 1,207\text{mm}^3 \\ &= 1,207 \times \left(\frac{1}{1,000} \text{m}\right)^3 \\ &= 1.207 \times 10^{-6} \text{m}^3 \end{aligned}$$

So a trillion pounds has a volume of:

$$\begin{aligned} 10^{12} \times 1.207 \times 10^{-6} \text{m}^3 &= 1.207 \times 10^6 \text{m}^3 \\ &= 1.207\text{m} \times 1000\text{m} \times 1000\text{m} \end{aligned}$$

**i.e. a square kilometre of pound coins that are 1.207m deep.**

A kilometre is 10 x 100m running track straights laid end to end.



Note a **cubic metre** has  $1,000^3 = 1 \text{ billion cubic mm}$ .

$$\pi = 3.141592654\dots$$





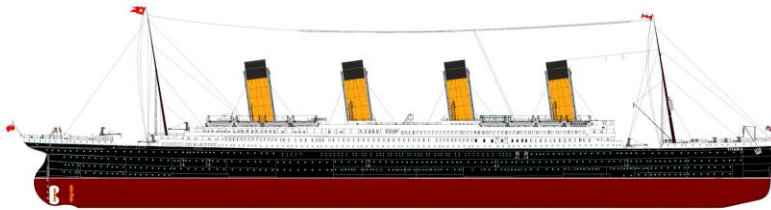
A £1 coin has a mass of 8.75g  
so **a trillion pounds has a mass** of:

$$10^{12} \times 8.75 \times 10^{-3} \text{ kg} = 8.75 \times 10^9 \text{ kg}$$

i.e. 8.75 billion kg or **8.75 million metric tonnes**

(a metric tonne is 1,000kg)

Note the **Titanic** had a mass of:  $46,000,000 \text{ kg} = 4.6 \times 10^7 \text{ kg}$



So a **trillion £1 coins has a mass equivalent to 190 Titanics.**

$$\frac{8.75 \times 10^9}{4.6 \times 10^7} \approx 190$$



**Other visualizations:**

[BBC What does a billion pounds look like?](#)

[WIRED What Apple's cash \(\\$250 billion\) looks like](#)