

Astronomical Numbers in Standard Scientific Notation

We usually write large astronomical numbers in so called Standard Notation or Standard Form. This notation is widely used also in physics and chemistry. Here is an example about the earth.

mass	$5,975 \cdot 10^{24}$ kg
radius	$1,276 \cdot 10^4$ km
distance to the sun	$1,496 \cdot 10^8$ km.



Earth
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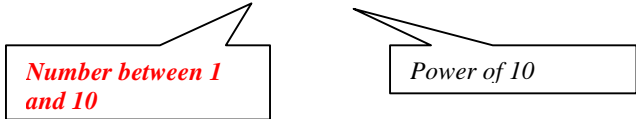
Similarly we use this notation to write very small numbers, for example the mass of a proton is: $1,7 \cdot 10^{-27}$ kg.

Notice that what we are doing in every case is to write the number as a number between 1 and 10 multiplied by a power of ten

Example

Radius of the planet of Venus is about 12 102 km

In standard notation: $12\ 102 = 1,2102 \cdot 10^4$



The mass of Venus is about $48 \cdot 10^{23}$ kg.

In standard notation this is:

$$\begin{aligned} &48 \cdot 10^{23} \\ &= 4,8 \cdot 10 \cdot 10^{23} \\ &= 4,8 \cdot 10^{24}. \end{aligned}$$

The mass of an electron is about 0,000 000 000 000 000 000 000 000 000 000 919 95 kg.

This small number in standard notation is much better written:

$$\begin{aligned} 0,000\ 000\ 000\ 000\ 000\ 000\ 000\ 000\ 000\ 000\ 919\ 95 &= \frac{91995}{10^{35}} \\ &= 91\ 995 \cdot 10^{-35} \\ &= 9,1995 \cdot 10^4 \cdot 10^{-35} \\ &= 9,1995 \cdot 10^{-31} \end{aligned}$$

1. Write in standard notation:
 - a) The distance of Venus to the sun: 107 000 000km
 - b) The distance of the sun to the pole star - 9 500 000 000 000 000 km
 - c) Light takes 5 hours and 20 minutes to travel from an astronomical object to the earth. How many seconds is this?
 - d) A molecule of water has mass 0,000 000 000 000 000 000 000 000 03kg.
 - e) The largest moon in our solar system around Jupiter has radius 5270 km.
2. The moon rotates around the earth in 27,3 days. How many seconds is this? Write this in standard notation.
3. The mass of the sun is about $1989 \cdot 10^{27}$ kg and the mass of the moon is about $7347 \cdot 10^{19}$. Write these numbers in standard scientific notation.
4. Which is the heaviest planet: Uranus with a mass of $8,7 \cdot 10^{25}$ kg or Neptune, with a mass of $1,0 \cdot 10^{26}$ kg ?
 - a) How many times heavier is the sun to the earth?
 - b) How many times lighter is the moon to the sun?
 - c) How many times lighter is the moon to the earth?

Work out your answers approximately.