

How big is the nanoscale?

Education in Chemistry

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rsc.li/EiC118-preciouswater

These exercises accompany the above article 'Precious Water'.

Exercise 1: Draw lines to match up the measurement described with the appropriate value and unit.

Height of an average sized horse		20 metres
Width of an E string on an acoustic guitar		231 pm
Width of a strand of DNA		0.254 mm
Height of a Scots pine tree		16 hands
Average height of an adult female		100 microns
Atomic radius of Calcium		2.5 nanometres
Thickness of a piece of paper		160 cm

Exercise 2: Skim read the article 'Precious water'. Below are six sentences showing some figures given in the article. Complete the sentences to give a full account of what the figure is describing. The first one is done for you.

Eg, 416,000 *km of mains water pipes in the UK...*

a. 5–100nm.....

b. 18,000.....

c. 5 a day,

d. 150–200.....

e. 40,000–50,000..... duringin 2016.

f. 1–5.....

Exercise 3: Below is a table with the measurements considered earlier. The measurements have been converted into metres and into nanometres in the first two rows. Complete the rest of the table.

To convert between metres and nanometres you will need to become familiar with the $\times 10^x$ button on your calculator, and your calculator will convert the answer to standard form for you. If you get stuck with this, get your teacher to show you how to use your calculator to do these conversions.

When converting m to nm you can add $\times 10^9$ to any figure in m.

When converting nm to m you can add $\times 10^{-9}$ to any figure in nm.

	Measurement	In metres	In nm
Height of an average sized horse	16 hands	1.63	1.63×10^9
Width of an E string on an acoustic guitar	0.254mm	0.000254	
Width of a strand of DNA	2.5nm	2.5×10^{-9}	2.5
Height of a Scots pine tree	20m		
Average height of an adult female	160cm		1.6×10^9
Atomic radius of Calcium	231pm	2.31×10^{-10}	
Thickness of a piece of paper	100microns	1×10^{-4}	

Exercise 4: Considering relative size

You will need: a pack of icon cards and a roll of toilet paper.

1. Roll out the toilet paper so you have 12 sheets in total.
2. Mark up each sheet with a power of ten scale in nanometres, $\times 10^1$ nm, $\times 10^2$ nm etc.
3. Place each icon card in the right place on your toilet paper scale.

Use reference materials (books, the internet) to find out the measurements of some things you consider very small. Convert these measurements to nanometres and put the cards on the scale.

Icon cards for exercise 4

	Average height of an adult female
Height of an average sized horse	Width of an E string on an acoustic guitar
Width of a strand of DNA	Atomic radius of calcium
Height of a Scots pine tree	Thickness of a piece of paper