<u>This is an explanation of the question N. 3 that we got on Friday 11/11.</u>

Question: A wire of gold is 1.00km long and has diameter of 1.00mm. The resistivity of gold is 22.4nΩm. What is the resistance of the wire?

Explanation: So, first we may start by looking at what we already know. We know the *length*, the *diameter*, and the *resistivity* of wire. Look at the table below:

Length	1.00 km = 1.00×10^3
Diameter	1.00 mm = 1.00×10^{-3}
Resistivity	22.4 nΩm = 22.4×10^{-9}

So, as chapter 1 says, 1.00 km is the same as 1.00 × km. "km" is only a variable. It is as "x" (10x). In our equation, it is important to include these variables.

To write our equation, we have to know which formulas we will use. At our formulae booklet you will find $R = \rho \frac{l}{A}$. We also need a formula to calculate the area of the wire. $A = \pi r^2$

So, here is the answer:

$$R = \rho \frac{l}{A} = 22.4\ n\Omega m \times \frac{1.00\ km}{\pi \times 0.5\ mm^2} = 22.4 \times 10^{-9} \times \frac{1.00\ \times 10^3}{\pi \times (0.5 \times 10^{-3})^2}$$

1. As we know, radius is equal to diameter divided by two.
2. Once again, *mm* counts as a variable. Therefore, it is in brackets.
3. To calculate this equation, use your calculator. To get resistance, write
   `22.4 × 10^(-9) × (1.00 × 10^3) ÷ (π × (0.5 × 10^(-3))^2)`

The result should be "28.5205658". However, we only have 3 significant figures in our question, so the answer should be "28.5". The resistance is therefore <u>28.5Ω</u>

Improvement:

As you might see, we have lot of numbers that actually could be crossed out. We can simplify the equation:

$$22.4 \times 10^{-9} \times \frac{1.00\ \times 10^3}{\pi \times (0.5 \times 10^{-3})^2} = 22.4 \times \frac{10^{-9} \times 10^3}{\pi \times 0.5^2 \times 10^{-6}} = 22.4 \times \frac{10^{-6}}{\pi \times 0.5^2 \times 10^{-6}} =$$
$$= 22.4 \times \frac{1}{\pi \times 0.25} = \frac{22.4}{0.25\pi}$$

As you see, we do not need to write the whole thing as it was done in the previous example. Just simplify!

Written by Artem Los, IB11C, Katedralskolan