THE UNIVERSITY OF RHODE ISLAND

Chemistry 112

Significant figures when using logs:

The General Rule:

The number of significant figures in the mantissa of a value expressed in scientific notation equals the number of significant figures to the right of the decimal in the logged value.

To see why this is, let's look at an example.

Find the log of 0.0000273 with the correct significant figures.

First, write the number in scientific notation:

$$0.0000273 = 2.73\times10^{-5}$$

Taking the log:

$$\log(0.0000273) = \log(2.73 \times10^{-5})$$

The log of a product is equal to the sum of the logs of each multiplier, so

$$\log(2.73 \times10^{-5}) = \log(2.73) + \log(10^{-5})$$

log(2.73) = 0.436: the answer has three significant figures, reflecting the possible error in the last digit of 2.73.

$\log(10^{-5}) = -5.000000000...$: the answer has an infinite number of significant digits because 10^{-5} is an exact number and has no error.

Then,

$$\log(2.73\times10^{-5}) = \log(2.73) + \log(10^{-5}) = 0.436 + (-5.00000000...)$$

requires that we use the rules for significant digits for sums, i.e., we can only add to the same decimal place as the value with the least significance. In this case, that is the third decimal place from 0.436, so

$$0.436 + (-5.000) = -4.564$$

or

$$\log(\underline{2.73} \times10^{-5}) = -4.\underline{564}$$

Using a calculator will give the following:

$$\log(\underline{2.73} \times10^{-5}) = -4.\underline{563}837353$$

Here, the mantissa of the number to be logged is underlined, showing 3 significant figures. The same number of significant figures is underlined *starting with the decimal point*. After rounding, the correct answer is obtained.

If you use scientific notation and the underlining technique, you will get the correct answer.