PAL Worksheet – Chem 6A

Scientific Notation

I. Place values in a number

Place values in a number change by factors of 10. The chart below shows the name and decimal form of common place values.

hundred thousands	ten thousands	thousands	hundreds	tens	ones	.	tenths	hundredths	thousandths	ten thousandths	hundred thousandths
100,000	10,000	1,000	100	10	1	.	0.1	0.01	0.001	0.0001	0.00001

II. Exponents

Here is the general formula showing an exponent:

$$X^n$$

Where **X** is the *base number*. **n** is the *exponent*, which indicates to multiply a number by itself a specific number (n) of times.

How many times would we need to multiply 10 to obtain the thousands place value? This number also corresponds to factors of 10.

_____

Write this as an exponent _____

III. Scientific notation is a format used to write numbers that combines place value with exponents.

In fields of science, some measurements are very very large and some are very very small. For example, the size of the Milky Way Galaxy is about 1,000,000,000,000,000,000 kilometers across. This measurement can also be expressed in ***scientific notation***, as: 1×10^{18} kilometers. The exponent here is related to the place values in the number. What do you think the relationship is between the exponent and the place values?

The diameter of a copper atom is 0.000000000255 meters. We can also express this in scientific notation, as: 2.55×10^{-10} meters. The exponent here is related to the place values in the number. What do you think the relationship is between the exponent and the place values?

Why do you think we write numbers in scientific notation?

Start Practicing!

1. **Converting decimals to scientific notation**. The following numbers are expressed in *decimal form*. Note that decimal form refers to any number in standard form. Write the decimal numbers in scientific notation.

   a) 60000 _____

   b) 813000000 _____

   c) 602200000000000000000000 _____

   d) 0.00005 _____

   e) 0.00000000009 _____

   f) 0.0000000840 _____

Note: Signficant figures (sig figs) also apply to numbers written in scientific notation. For example, the value 1000 has one sig fig. When writing in scientific notation, there should also be one sig fig: **1** $\times 10^3$. The **1** is the value that retains one sig fig. We will be working on

sig figs in the next worksheet. Check your work above. Do all your values in scientific notation retain the same number of significant figures as the decimal form of the value?

2. **Converting scientific notation to decimals**. The following numbers are expressed in scientific notation. Write the numbers in decimal form.

   a) 3×10^4 _____

   b) 6.41×10^4 _____

   c) 3.4×10^{-2} _____

   d) 1.847×10^{-6} _____

IV. Performing scientific notation calculations using a calculator

We'll be using numbers expressed in scientific notation in our calculations this semester. There may be more than one way to enter numbers in scientific notation on your calculator. If this is the case for your calculator, determine what works best for you, and continue using those same keys each time.

For example, the scientific notation key may look like 10^x or like *EE*. You may also have to push the 2nd key or the SHIFT key before pushing your scientific notation key. Keep in mind that the scientific notation key represents " $\times 10^n$ " portion of the number.

1. Find the scientific notation key on your calculator.

Which key do you have: _____ Or, does your key look like something else? If so, what does it look like?

2. Do you need to push 2nd or SHIFT to use it? **YES** / **NO**

3. Describe in detail where these keys are located on your calculator:

4. Write the key combination you need in order to enter the following numbers and then write in decimal form:

   a. 2×10^3

   Key combo:_____

   Decimal form: _____

   b. 6.022×10^{23}

   Key combo:_____

   Decimal form: _____

   c. 5.4×10^{-3}

   Key combo:_____

   Decimal form: _____

   d. -3.7×10^{-4}

   Key combo:_____

   Decimal form: _____

5. Make a **movie on your phone** or tablet showing how you key in 5.4×10^{-3} and -3.7×10^{-4}. Note that you may have to play around with how to enter the negative signs.

6. Watch another student's movie. Did they have to use the same steps on their calculator as you did? If not, what did they do?

7. Solve the following:

a. $(1.5 \times 10^{3}) \times (7.9 \times 10^{-8}) =$ _____

b. $(5.13 \times 10^{-2}) \times (6.022 \times 10^{23}) =$ _____

c. $\dfrac{1}{6.022 \times 10^{23}} =$ _____

d. $\dfrac{2.998 \times 10^{8}}{6.626 \times 10^{-34}}$ _____

8. Make a **movie** on your phone or tablet showing how you perform the calculation for question 6b and share it with another student.