Guided notes: Scientific notation

When using Scientific Notation, there are two kinds of exponents: positive and negative.
The number in the front is a number between ___ and ___, called the _____.

When changing scientific notation to standard notation, the exponent tells you if you should
move the decimal:

- **POSITIVE** exponent = move the decimal to the **RIGHT**:
  4.08×10^3 = 4 0 8 0 (show arrows and move decimal)

  *The exponent tells you how many places to move the decimal.

- **NEGATIVE** exponent, move the decimal to the **LEFT**:
  4.08×10^{-3} =   4 0 8

  *The exponent tells you how many places to move the decimal.

- If an exponent is positive, the number gets _____, so move the decimal to the
  _____. If an exponent is negative, the number gets _____, so move the
  decimal to the _____.

Try changing these numbers from scientific notation to standard notation

1) 9.678×10^4 _____

2) 7.4521×10^{-3} _____

3) 8.513904567×10^7 _____

4) 4.09748×10^{-5} _____

Standard Notation to Scientific Notation:
    1) First, move the decimal after the first whole number:
                3 2 5 8. (use arrows to show how you move the decimal)

    2) Second, add your multiplication sign and your base (10).
                3 . 2 5 8 x 10

    3) Count how many spaces the decimal moved and this is the exponent.
                3 . 2 5 8 x 10   (add the correct exponent)

Try changing these numbers into scientific notation

1) 9872432   _____

2) .0000345   _____

3) .08376   _____

4) 5673   _____

MULTIPLYING in scientific notation
Multiply the mantissas and ADD the exponents

$$.00000055 \times 24{,}000$$
$$= (5.5 \times 10^{-7}) \times (2.4 \times 10^4)$$
$$= (5.5 \times 2.4) \times 10^{-7+4}$$
$$= 13 \times 10^{-3}$$
$$= 1.3 \times 10^{-2}$$

DIVIDING in scientific notation
Divide the mantissas and SUBTRACT the exponents

- $(7.5 \times 10^{-3})/(2.5 \times 10^{-4})$
  $$= 7.5/2.5 \times 10^{-3-(-4)}$$
  $$= 3 \times 10$$
  $$= 30$$

ADDING or SUBTRACTING in scientific notation
1. First make sure that the numbers are written in the same form (have the same exponent)
    3.2×10^3 + 40×10^2 (change to 4.0×10^3)

2. Add (or subtract) first part of exponent (mantissas)
    $3.2 + 4.0 = 7.2$

3. The rest of the exponent remains the same
    Answer: 7.2×10^3

How do you make the exponents the same?

1) Let's say you are adding 2.3×10^3 and 2.1×10^5. You can either make the 10^3 into the 10^5 or visa versa. If you make the 10^3 into 10^5, you are moving up the exponent two places. You will need to move your decimal place in the mantissa down two places to the left.

2) $2.3 \times 10^3 = .023 \times 10^5$
   - Take 2.3 and move the decimal three places to the right. It equals 2300.
   - Take .023 and move it five places to the right…it is still 2300
   - Now add the two mantissas $(2.1 + .023) = 2.123$
   - Add the exponent ending: 2.123×105

In conclusion
    *if you increase (↑) the exponent, you must move the decimal in the mantissa to the left (←) the same number of places.
    *If you decrease (↓) the exponent, you must move your decimal point to the right (→) in the mantissa that number of places.