Concept: Scientific Notation

Name:

Warm Up

1. Express each of the following as a power with a base of 10.

   Example: $100 = 10^2$

   (a) $1000 = 10^3$ (b) $10{,}000 = 10^4$ (c) $1{,}000{,}000 = 10^6$

   (d) $0.01 = 10^{-2}$ (e) $0.0001 = 10^{-4}$ (f) $0.000{,}01 = 10^{-5}$

COMPUTER COMPONENT

Instructions: In UMATH X follow the **Content Menu** path:

Exponents > **Scientific Notation**

- Work through all Sub Lessons of the following Lessons **in order**:
  - *Why Use Scientific Notation?*
  - *Scientific Notation of Large Numbers*
  - *Scientific Notation of Small Numbers*
  - *Volume Formulas Involving Exponents*
  - *Examples*

Additional Required Materials: Scientific calculator

- As you work through the computer exercises, you will be prompted to make notes in your notebook/math journal.

NOTES

1. Fill in the blanks.

   - Very ***large*** or very ***small*** numbers are often written in ***Scientific Notation.***
   - Numbers written in scientific notation must be expressed as a ***product*** of:
   - A number ***less*** than ***10*** but ***greater*** than or ***equal to 1***
   - A ***power*** of ***ten.***

Example:

14,000,000,000 in scientific notation is $\boldsymbol{14 \times 10^9}$

Steps to expressing large numbers in scientific notation:

Step 1: Place a ***zero*** after the first ***non-zero*** digit.

Step 2: Drop the ***trailing*** zeros.

Step 3: ***Multiply*** by a ***power*** of ***ten*** to compensate for moving the ***decimal.*** (*Hint: Count the number of places the* ***decimal*** *is* ***moved.****)*

Practice:

"The Andromeda Galaxy contains at least 200,000,000,000 stars."
(http://www.ieer.org/clssroom/scinote.html)

200,000,000,000 = 2×10^{11}

Steps to expressing small numbers in scientific notation:

Step 1: Write the ***decimal*** after the first ***non-zero*** digit.

Step 2: Drop the ***preceding*** zeros.

Step 3: ***Multiply*** by a ***power*** of ***ten*** to compensate for moving the ***decimal.*** (*Hint: Count the number of places the* ***decimal*** *has been* ***shifted*****)**

Remember: *The exponent will be* ***negative****.*

Practice:

"The weight of an alpha particle, which is emitted in the radioactive decay of Plutonium - 239, is 0.000,000,000,000,000,000,000,000,006,649"
(http://www.ieer.org/clssroom/scinote.html)

0.000,000,000,000,000,000,000,000,006,649 = 6.649×10^{-27}

OFF COMPUTER EXERCISES

1. Express each of the following large numbers in scientific notation.

(a) 120 = $\mathbf{12 \times 10^{1}}$

(b) 3000 = $\mathbf{3 \times 10^{3}}$

(c) 65,000 = $\mathbf{65 \times 10^{3}}$

(d) 34,000 = $\mathbf{34 \times 10^{3}}$

(e) 45,000,000 = $\mathbf{45 \times 10^{6}}$

(f) 4,000,000,000,000 = $\mathbf{4 \times 10^{12}}$

2. Express each of the following small numbers in scientific notation.

(a) 0.002 = $\mathbf{2 \times 10^{-3}}$

(b) 0.000,0045 = $\mathbf{4.5 \times 10^{-6}}$

(c) 0.000,003 = $\mathbf{3 \times 10^{-6}}$

(d) 0.000,000,64 = $\mathbf{6.4 \times 10^{-7}}$

(e) 0.004 = $\mathbf{4 \times 10^{-3}}$

(f) 0.000,000,000,000,000,08 = $\mathbf{8 \times 10^{-17}}$

3. Express each in standard notation.

Example: $1.24 \times 10^{-3} = 0.001\ 24$

(a) 2.5×10^{-4} = $\mathbf{2.5 \times 0.0001}$
= **0.00025**

(b) 2.5×10^{8} = $\mathbf{2.5 \times 1000000000}$
= **2 500 000 000**

(c) 2.51×10^{-6} = $\mathbf{2.51 \times 0.000001}$
= **0.00000251**

(d) 2.51×10^{6} = $\mathbf{2.51 \times 1000000}$
= **2 510 000**

4. Express each in scientific notation.

(a) 13,000 = $\mathbf{1.3 \times 10^4}$

(b) 0.005,06 = $\mathbf{5.06 \times 10^{-3}}$

(c) 7,091,000 = $\mathbf{7.091 \times 10^{6}}$

(d) -0.000,005 = $\mathbf{-5 \times 10^{-6}}$

(e) 36 × 42 × 456 = **689,472**= $\mathbf{6.89472 \times 10^{5}}$

Express your answers in the following questions in scientific notation.

5. The measured daily deposit of a pollutant on a city is approximately 3.5×10^{-5} g/cm. If a city has an area of 200 square kilometers and the pollutant is distributed evenly, *calculate the amount of pollutant that falls on the city.*

   (a) *in one day.*

   3.5 × 0.00001 = 0.000035gm/cm

   (b) *in one year.*

   0.000035 × 365= 0.12775gm/cm

6. If 1100 silkworm eggs weigh 1.3g, *how much does each egg weigh?*

   1.3÷1100=0.0011818182= $\boldsymbol{1.1 \times 10^{-3}}$***g***

*A **googol** can be written in conventional notation as follows:*

1 googol $= 10^{100}$
= 10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,
000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,
000,000,000

*A **googolplex** is the number one followed by one googol zeroes, or ten raised to the power of one googol:*

$10^{googol} = 10^{(10100)}$.

In the documentary Cosmos, physicist and broadcast personality Carl Sagan estimated that writing a googolplex in base-10 numerals (i.e., "1,000,000,000...") would be physically impossible, since doing so would require more space than the known universe occupies.
http://en.wikipedia.org/wiki/Googol

Challenge

Interesting Facts:

The earth is nearly 150,000,000 km (93,000,000 miles) from the sun.
http://en.wikipedia.org/wiki/Astronomical_unit

The speed of light is approximately 300,000 kilometre per second (186,000 miles per second).
http://www.school-for-champions.com/science/lightspeed.htm

If the sun unexpectedly disappeared, *how much time would go by before the sky on earth was dark?*

150, 000, 000 ÷ 300, 000 =500 seconds or 8 minutes and 20 seconds