***Scientific Notation***

Pluto, the dwarf planet, is 3,670,000,000 miles from the sun. Mercury, the closest planet to the sun, is 35,880,000 miles from the sun.

**Reference Chart**

1,000 One Thousand

1,000,000 One million

1,000,000,000 One billion

1,000,000,000,000 One trillion

In situations when we're using very large and very small numbers, it is often easier to use scientific notation. Here are those same distances, written in scientific notation:

From sun to Pluto: 3.67 \* 109 miles

From sun to Mercury: 3.59 \* 107 miles

 **Practice — Powers of Ten**

The first thing we need to do is to make sure that we understand powers of ten.

 **1)** Copy and complete the table.

101 =

102 =

103 =

104 =

109 =

1015 =

 **2)** What do you notice about powers of ten?

 **3)** How many times does 103 go into 104 ? Try to answer without your calculator.

 **4)** How many times does 1026 go into 1027? To answer without your calculator.

 **5)** How many times does 103 go into 105 ? Explain.

 **Practice — Other Numbers Multiplied by Powers of Ten**

 **6)** Copy and complete this table.

4 \* 101 =

5 \* 102 =

6 \* 103 =

7.8 \* 104 =

2 \* 109 =

3.5 \* 1015 =

 **7)** What happens to a number when you multiply it by a power of ten?

 **Main Section — Convert to Scientific Notation**

In this section, numbers are given in standard notation. Express them in scientific notation.

 **8)** The half-life of Uranium is 250,000 years

 **9)** The circumference of the Earth at the equator is about 24,900 miles

 **10)** One million

 **11)** One of the fastest supercomputers in the world is NEC's Earth Simulator, which operates at a top-end of 40 teraflops (forty trillion operations per second).

 **Main Section — Convert FROM Scientific Notation**

Write each of these numbers in standard notation. (In other words, do the opposite of what you were doing in questions #8 through #11)

 **12)** 7.2 \* 108 **13)** 8.03 \* 106

 **14)** The speed of light is approximately 6.71 \* 108 miles per hour. Express this number in standard notation.

 **Main Section — Different ways to write the same number**

 Depending on who you are working with, some might prefer to use scientific notation with different place values. Some people might write 8.8 \* 104, but someone else might write 88 \* 103

 **15)** Show that both versions of this number have the same value.

 **16)** Write 7,700,000,000 in scientific notation at least three different ways.

 **17)** Check your answers to all questions so far.

 **Just for fun (Optional)**

 The reference guide at the beginning of this lesson gives the names for large numbers up to one trillion. If you’re interested, look up the next few names for large numbers.

 **Notes**

 Choose a question from each of the main sections to copy into your notes.

 **Challenge**

 **18)** How many miles can light travel in one minute? (Refer to the speed of light from question #12)

 **19)** If it takes light 8.3 minutes to reach the Earth from the Sun, what is the distance of the Sun from the Earth?

 **20)** The state of Colorado covers about 1.04 \* 105 square miles. The Indian Ocean covers about 2.81 \* 107 square miles. How many times larger than Colorado is the Indian Ocean?

**Answers**

 **1)** 101 = 10

102 = 100

103 = 1,000

104 = 10,000

109 = 1,000,000,000

1015 = 1,000,000,000,000,000

 **3)** Ten times **4)** Ten times

 **5)** A hundred times

 **6)** 4 \* 101 = 40

5 \* 102 = 500

6 \* 103 = 6,000

7.8 \* 104 = 78,000

2 \* 109 = 2,000,000,000

3.5 \* 1015 = 3,500,000,000,000,000

 **8)** 2.5 \* 105

 **9)** 2.49 \* 104 OR 2.5 \* 104

 **10)** 1 \* 106

 **11)** 40.0 \* 1012 or 4.0 \* 1013

 **12)** 720,000,000 **13)** 8,030,000

 **14)** 671,000,000 mph

 **15)** Both equal 88,000

 **16)** Some examples: 770 \* 107, 77 \* 108, 7.7 \* 109, 0.77 \* 1010

**Challenge**

 **18)** 11,183,333.3 miles per minute

 **19)** 92,821,666.4 miles **20)** 270.19 times