**Teacher’s Name:** Ms. Singh  **05/02/2019**

**Unit:** Fundamentals of Electronics **Topic:** Engineering Notation

**NYS STANDARDS:**

1. **STANDARD 2:** Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

**NYS Learning Standards for Career and Technical Education:**

1. **CDOS S3a:**Students will demonstrate mastery of the foundation skills and competencies essential for success in the workplace.

**Common Core Learning Standards:**

1. **RST.9-10.3:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
2. **HSN.Q.A.1:**Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

**Materials:**

Notebooks

Writing Utensils

Calculator

**Opening Task:**

1. How many electrons are in one coulomb of charge?
2. How can we represent this number in scientific notation?

**Motivation/Answer to Do Now:**

There are 6,240,000,000,000,000,000 electrons in one coulomb of charge. Let’s review the rules of scientific notation. The number cannot be bigger than 10 and less than 1. The power of ten value determines how many spaces exist before or after the decimal point. If we wanted to represent that number in scientific notation we would simply write 6.24 x 10^18. Do you think that scientific notation is the most efficient way that we could represent this value?

**Aim:** How can we represent numbers correctly using engineering notation and their metric prefixes?

**Instructional Objectives:**

*S.W.B.A.T.:*

* convert numbers into engineering notation
* identify all of the basic metric prefixes
* assess which metric prefix to use

**Vocabulary:**

Engineering Notation

Scientific Notation

Metric

Prefix

**Presentation:**

1. Question: What is a coulomb?
	1. Answers include: a quantity of the unit of charge that is transferred in one ampere in one second.
2. Question: What is the value of the electrons in one coulomb of charge?
	1. Answers include: 6,240,000,000,000,000,000 electrons, 6.24 x 10^18 or 6.24 quintillion
3. Question: How can we make this number easier to write over and over and use it in math equations?
	1. Answers include: scientific notation, engineering notation
4. Scientific notation is great, but in engineering we use something called the Engineering Notation. The engineering notation is similar to the scientific notation but it groups the number of spaces into groups of three.
5. Engineering Notation
	1. Engineering notation is a similar to scientific notation but the exponent of ten must be divisible by three .
6. Question: When would you use engineering notation?
	1. Answers include: When trying to represent large or small numbers in an easy to read and use format.
7. Question: How do you think that we use engineering notation if it is similar to scientific notation but grouped into spaces of three?
	1. Answers include: you do the same steps except you go by three, there are specific names for the three spaces that you move.
8. Steps to Convert a number to engineering notation
	1. Decide which direction you need to move the decimal point to reach the smallest whole number.
	2. Move the decimal place to the right or left in counts of three until you have the smallest whole number possible
	3. Count how many places you moved
	4. Present the number as a power of 10. When converting from a larger unit to a smaller unit, move the decimal to the right. When converting from a smaller unit to a larger unit, move the decimal point to the left.
	5. Check the metric prefix chart and write the corresponding prefix for the power of 10 you came up with
9. Tips for converting
	1. When converting from a larger unit to a smaller unit, move the decimal to the right
	2. When converting from a smaller unit to a larger unit, move the decimal to the left
	3. Would you move these decimals to the left or the right?
		1. x10^6 to x10^0 Right
		2. Kilo to 10^0 Right
		3. x10^-3 to x10^0 Left
		4. Nano to x10^0 Left
		5. x10^6 to x10^3 Right
10. I do: 1,000,000 this becomes 1 x 10^6 which is equal to 1M
11. We do: .000001 this becomes 1 x 10^-6 which is equal to 1µ
12. You do: 3,400 becomes 3.4 x10^3 which is equal to 3.4K

**Summary:**

1. What are the main metric prefixes that we use?
	1. Answer: Kilo (K), Mega (M), Giga (G), mili(m), micro(µ), nano(n)
2. What is the difference between scientific notation and engineering notation?
	1. Answer: Engineering notation is scientific notation that uses groups of three instead of individual digit spaces
3. How do you convert a standard number into engineering notation?
	1. Answers Include: You can first put it into scientific notation and then see how many times that number is divisible by 3; or you can just move the decimal place to the right or left depending on if the number is getting larger or smaller and then count how many places you moved. The value should then be used to identify which metric prefix should be used. For example if you move the decimal point three places to the left from a standard number the metric prefix that I would use would be K for Kilo.

**Immediate Application:**

Complete the Engineering Notation Worksheet

**Extension Activity OR Homework:**

Create your own neatly drawn metric prefix chart and scale in the reference part of your notebook. Feel free to color code it or come up with different ways to draw/remember it. The only purpose of this is to help you remember and understand the information.

**Accommodations:**

Students are exposed to multiple formats of engineering notation, which proves that differentiation occurs. The formats include visuals from the presentation, text from the presentation, notes from the presentation, a demonstration on the board and the act of actually using the scientific notation. With all these different approaches to the topic all students should be accounted for.