Dear future Honors/Magnet Chemistry student,

Hello! Here in the chemistry department, we are very excited to help you start your chemistry journey soon! Chemistry is an abstract science. This means that a lot of what we work with are things we can’t always see, like molecules, atoms, and electrons. We will need to find ways to picture these things we cannot see and attribute to them actions and qualities based on observations on a macroscale. Basically, we try to explain the stuff we see happen with a deep explanation of what happens on the atomic level, which we cannot see with our own eyes.

There is some math (algebra and scientific notation) involved sometimes, so we’ll work on these skills as well.

This packet is designed to give you a quick algebra/scientific notation review as well as work on these abstract thinking skills. Please make sure that you are completing this towards the end of your break, so that you don’t forget everything before you come to class. It is up to your individual teacher whether or not to grade this packet, but you will be responsible for the information included on the first test.

Your teacher’s website should be posted on the school website, so you can find out how to contact them for questions. Their e-mail will also be on the school’s directory page.

Looking forward to starting our journey through chemistry,

Your Future Chemistry Teachers 😊
1. Please use your algebra skills to solve the following problems for 'x':
   a. \(2x - 4 = 8\)
   b. \(\frac{x}{2} + 3 = 5\)
   c. \(3(x - 4) + 5 = 11\)
   d. \(3x + 5 = x - 9\)

2. Perform the following conversions WITHOUT using King Henry! He DIED, so we won’t use him in chemistry. For help with this, research ‘dimensional analysis.’ This is THE method for unit conversions in chemistry. We use it for most of the math that we do, and it works every time. The most important part of dimensional analysis is the unit, not the number. The unit helps you figure out how to set up the conversion. We’ll show you the first one.
   a. 67.2 centimeters \(\rightarrow\) inches
      i. \(\frac{67.2 \text{ cm}}{1} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 26.5 \text{ in}\)
        *We canceled out the cm, so I was left with the unit we wanted. Then, anything on the bottom is divided, while the top is multiplied. Also note that we gave the unit in the answer. Now you try!
   b. 49 kilograms \(\rightarrow\) milligrams
   c. 160 pounds \(\rightarrow\) kilograms
   d. 365 days \(\rightarrow\) seconds
   e. 55 miles per hour \(\rightarrow\) meters per second

3. Take the following numbers in standard notation and put them into scientific notation.
   For help on this, visit Khan Academy and search ‘scientific notation.’
   a. 61,500
   b. 0.00000568
   c. 3,000,000
   d. 64,960,000
   e. 0.000102

4. Take the following scientific notation values and turn them into numbers in standard notation.
   a. \(1.09 \times 10^3\)
   b. \(4.22 \times 10^{-8}\)
   c. \(3.01 \times 10^4\)
   d. \(5.179 \times 10^{-2}\)

5. Why might it be easier for us to use scientific notation in science where we talk about lots and lots of really tiny things, like atoms?

6. A mole is a unit of measurement in chemistry. It’s used to measure the amount of things. In chemistry, we’re usually talking about atoms or molecules, but theoretically, you could have a mole of puppies, toasters, or even doughnuts! BEFORE YOU LOOK ANYTHING UP, ANSWER THIS QUESTION: If a mole is equal to \(6.022 \times 10^{23}\) things, how much space do you think a mole of each of the following would take up?
   a. Post-It notes
   b. Kittens
   c. Water molecules
d. Basketballs
e. Oxygen molecules
f. Pennies (how much would this be, in U.S. dollars?)

7. Now, go look up this stuff. Were you surprised at the real answers? Find a couple more examples or come up with some on your own (for example, a mole of [insert your favorite food] could make a tower of [favorite food] that stretches [height of tower]).

8. This number, 6.022x10^{23}, is called Avogadro’s number after the Italian scientist that discovered it. Try writing this out in standard notation.

9. Last question! :) Let’s take this scientific notation and try to USE it in some real chemistry math. If you need help putting this into your calculator, GOOGLE IT!
   a. Find the energy, E, of a wave with a frequency of 4.14 x 10^{14} s\textsuperscript{-1}.
      \[ E=\hbar v \] \hbar = Planck’s constant, 6.626 x 10^{-34} J\textsuperscript{s} \quad v= frequency
   b. I find that I have 2 moles of water in a cup. If 1 mole = 6.022 x 10^{23} molecules, how many molecules of water do I have? Use your new dimensional analysis!