Honors Chemistry Summer Assignment
2021-2022
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Puller 208

Hello Honors Chemistry students! I hope your summer is filled with friends, family, and fun. As summer progressives forward I wanted to make sure you were thinking forward and preparing for Honors Chemistry in the Fall. Complete the following 8 parts of this summer assignment to get a basic understanding of some essential concepts for chemistry. Most of this should be review!

Part I - Introduction to Chemistry

Before you jump right in, it's important that you understand what chemistry is, its origins and meaning. Watch the short video using the link below. The video is called, "Introduction to Chemistry".

https://www.youtube.com/watch?v=izeuGr0lbN0

Using the following URl address to access a podcast posted on YouTube, answer the remaining questions and complete all tasks in part one.

http://www.youtube.com/watch?v=Exbn-AJIJAs

1. What is the definition of chemistry?
2. What is a chemical element?

There are approximately 115 chemical elements on the periodic table. Each element has a chemical name and a chemical symbol such as sodium (Na). You will notice that not all of the chemical symbols seem to correspond to their name. Look at the examples below.

Chemical Name	Chemical Symbol
Potassium	K
Carbon	C

Notice that "C" for carbon makes sense but "K" for potassium does not.

This occurs because the symbols of these elements are derived from the Latin language. It is vital that you are VERY familiar with the most common elements. We will be using these throughout every concept in this class. You need to know the elements in the table below. You should not have to ask me “what element is this?”.

Element Name	Element Symbol		Element Name	Element Symbol
Hydrogen	H		Argon	Ar
Helium	He		Potassium	K
Lithium	Li		Calcium	Ca
Beryllium	Be		Iron	Fe
Boron	B		Cobalt	Co
Carbon	C		Nickel	Ni
Nitrogen	N		Copper	Cu
Oxygen	O		Zinc	Zn
Fluorine	F		Bromine	Br
Neon	Ne		Silver	Ag
Sodium	Na		Tin	Sn
Magnesium	Mg		Iodine	I
Aluminum	Al		Barium	Ba
Silicon	Si		Platinum	Pt
Phosphorus	P		Gold	Au
Sulfur	S		Mercury	Hg
Chlorine	Cl		Lead	Pb

Note: When memorizing elements and symbols, keep in mind the spelling should be close and symbols involving more than one letter are always written with the first letter capitalized and the second letter lowercase. This is important to help identify when one element ends and the next begins.

Example: SI - would be a compound containing sulfur and iodine
Si - would be the element silicon

Scientific method is a logical, systematic approach to the solution of a scientific problem. Although the precise steps of this method can vary widely, requirements include making observations, testing hypotheses, and developing theories from results.

Watch the following clip from a Myth Busters episode that provides an example of this process. Answer the questions as you view the clip to reinforce your knowledge of the scientific method.

http://www.youtube.com/watch?v=A20BLo0gxYY

1. What is the problem presented?

2. What do you think the Myth Busters hypothesis is?

3. Why might moisture not be needed on the moon to make a clear footprint?

4. What is the Myth Busters procedure in this experiment? Write a chronological list in numerical format of steps. Make sure to use complete sentences.

5. What was the Myth Busters conclusion? Discuss if their hypothesis was right and how they know for sure.

Scientific Method Continued....

In this class, you are going to be required to create your own experiments in some instances rather than being given a step-by-step procedure. This can be a very difficult task for a lot of students so here are some important things to keep in mind:

Hypotheses: The hypothesis of an experiment should be clearly identified before attempting to set up an experiment. This is usually an "if-then" statement which is testable and can be proved or disproved. For example, "If I introduce a flame to diethyl ether, then I will get an explosion." To test your hypothesis one must have controls and variables where controls are properties that are kept constant such as temperature or pressure and variables are factors affecting change in order to view a relationship.

There are two variables that should be present in an effective experiment: an independent variable and a dependent variable. Using your own credible online resources, define the following two terms.

Independent Variable:

Dependent Variable:

How many factors or variables should be changing within an experiment?

Why do you think this is important?

Data: There are two types of data that can be collected from an experiment: qualitative and quantitative. Using the URL listed below, define these two terms. Make sure to analyze examples given to fully understand the two. In class, we will discuss further what makes good qualitative and quantitative observation. For now, understanding what they are is sufficient.

http://www.dbooth.net/mhs/chem/qualquant.html

Qualitative Data:

Quantitative Data:

Experimentation: Testing the hypothesis usually required multiple trials to assure results accurate and precise. These are two more terms in which it will be vital for you to understand. To be accurate is not the same as to be precise. Use the following link to help you better understand the two and write a definition for each below.

https://wp.stolaf.edu/it/gis-precision-accuracy/#:~:text=Precision%20is%20how%20close%20measure,are%20both%20precise%20and%20accurate.

Accuracy:

Precision:

Once more, we will elaborate on these terms and how they apply to our specific experimentation in class this year. For now, simply understand their nature and their differences.

Conclusions: Drawing conclusions and discussing the conclusions are often the most forgotten or skipped over part of the scientific method in middle school and high school laboratories. Although sometimes skipped, this is one of the most important parts of the process and will be a part that we put a lot of emphasis on in this class. It is difficult for most students to draw conclusions about an experiment and relate their conclusions back to scientific concepts. It is also a struggle to write clear statements and explanations of findings. In honors chemistry, we will be working on this throughout the entire year. In our conclusions, there are two elements that often appear. These include a scientific law and a scientific theory. As a student who will be participating in lab regularly, you must understand the difference between these two terms and begin utilizing them in your conclusions. Watch the short video clip below to help define these terms.

http://www.youtube.com/watch?v=zGgIdrD20do

Scientific Law:

Scientific Theory:

End of Part I

Part II- The Metric System

In this section, we introduce the standards for basic measurement in the scientific world. Scientists conduct experiments where data is collected and shared all over the globe. Although the United States has their own standards for measurement, the scientific world uses the International System of Units (SI) or what is commonly known as the metric system. Data collection and its accuracy are crucial in chemistry labs. Scientists use the same system of measurement so that data can be easily shared and compared with other data. The metric system provides that unity. Below are the fundamental units, also known as the "base" units, which have been defined in the metric system.

Table 1 – The Seven Fundamental Units of Measurement (SI)

Physical Property	**Name of Unit**	**Symbol**
Length	meter	m
Mass	kilogram	kg
Time	second	s
Temperature	Kelvin	K
Amount of substance	mole	mol
Electric current	ampere	A
Luminous intensity	candela	cd

In chemistry we commonly use the first five. The metric system is a decimal system where prefixes are used to indicate fraction and multiples of ten. The same prefixes can be used with any of the above base units. The next table displays the identified prefixes. The more familiar you become with this system the easier calculations will be in the future.

METRIC PREFIXES

	PREFIX	SYMBOL	MULTIPLE
BIG	Tera-	T	1,000,000,000,000.
	*giga -	G	1,000,000,000.
	*mega -	M	1,000,000.
	*kilo -	k	1,000.
	* hecto -	h	100.
	*deka -	da	10.
	meter	m	1
	gram	g	1
	liter	L	1
	*deci -	d	1/10
	*centi -	c	1/100
	*milli -	m	1/1000
	*micro	μ	1/1,000,000
	*nano -	n	1/1,000,000,000
SMALL	pico -	p	1/1,000,000,000,000

*These are the prefixes you should learn because you will encounter them most often.

For this assignment, it is important to be able to convert within the metric system, such as from centimeters to kilometers. To help aid in the understanding of this process watch the following YouTube video. Pay particular attention to the "dimensional analysis" method as this is the method that you will be using in this class and with many other conversions that we will be discussing. Watch the video, analyze the example problem shown below and then try the practice problems.

http://www.youtube.com/watch?v=SYkmadc2wOI

Example: How **many millimeters are equivalent to 15 hectometers*?***

Step #1: Determine what you know including the unit and what unit you are looking for in the end. Then, place the given over one (remember any whole number can be put over one) to begin the problem.

Given: 15 hectometer (hm)

Looking for: *?*?? millimeters (mm)

Step #2: Determine the conversion factors needed to get from hectometers to millimeters. From the metric system displayed above, 1 hm = 100 m and 1m = 1000 mm. Set these conversion factors up in fraction form so that the appropriate units cancel leaving you with only the unit desired for the final answer.

Step #3: Before calculating your answer, double check that all units cancel out but the unit desired in the problem. Remember: If the same unit is on the top of the fraction as the bottom, they cancel!

Step #4: Calculate the final answer. Multiple across the top and across the bottom, then divide as your last step.

Now Your Turn: *All work, units, numbers, etc. count towards full credit on each problem.*

1. How many kilograms are equal to 1500 centigrams

2. Determine the number of liters in 6578 milliliters.

3. How many decimeters are equivalent to 0.45 kilometers.

****If you need more practice with this conversion method and within the metric system seek other online videos, resources, etc. to help you. Please keep in mind the method in which you will be required to show these conversions as there are other ways in which to approach the problem.*

(END OF PART II)

Part III: Scientific Notation

In chemistry, we commonly measure quantities that are very SMALL or very LARGE. For example, 197 grams of gold contains approximately 602,000,000,000,000,000,000,000 gold atoms

The mass of one gold atom is approximately 0.000 000 000 000 000 000 327 grams

Numbers like these can be better expressed using scientific notation. This notation provides an easier way to state values such as these without the inconvenience of writing out a WHOLE LOT of zeros.

The following video clips are listed to give you a more detailed explanation. The goal for this assignment is to be able to take a number in **standard notation** and express it in **scientific notation** and vice versa.

http://www.youtube.com/watch?v=zlv1ZK8fGS4

http://www.youtube.com/watch?v=aFv3DNgPhsQ

Now Your Turn: *Convert the following numbers from scientific notation to standard notation or standard notation to scientific notation.*

1. 0.0000657 =

2. 5.01×10^{-7} =

3. 3.19×10^{8} =

4. 12,000,000 =

Calculating with Numbers in Scientific Notation

Another common mathematical computation is when numbers expressed in this notation are added/subtracted or multiplied/divided. Watch the following videos to help you better understand the proper way to carry out these various operations and then try some on your own for practice.

Adding/Subtracting- http://www.youtube.com/watch?v=PYTp75sryWA

Multiplying/Dividing- http://www.youtube.com/watch?v=ciFOlirz4Js

Now Your Turn*: Perform the following operations.*

1. $(6.8 \times 10^{3}) \times (4.54 \times 10^{6}) =$

2. $(3.95 \times 10^{5}) + (7.8 \times 10^{3}) =$

3. $(2.0 \times 10^{-4}) \times (8.5 \times 10^{5}) =$

4. *(7*.83 x 10^{-2}) - (2.20 x 10^{-2}) =

5. divide (9.2×10^{-3}) by $(6.3 \times 10^{4}) =$

6. $(8.23 \times 10^{4}) - (3.02 \times 10^{5}) =$

7. divide (2.4×10^{6}) by $(5.49 \times 10^{-9}) =$

8. $(6.423 \times 10^{9}) + (5.001 \times 10^{-8}) =$

END OF PART III

Part IV: Algebraic Transformations

A crucial part of being successful in chemistry is having strong mathematical skills. Although the math in this course is not extremely difficult, it does require solid knowledge of algebra including solving equations. There is a math prerequisite to be enrolled in this course; therefore you should be able to complete the following. All of the equations below are ones that you will see throughout this course at some point along with many others. If you begin struggling, seek help from online resources for further guidance.

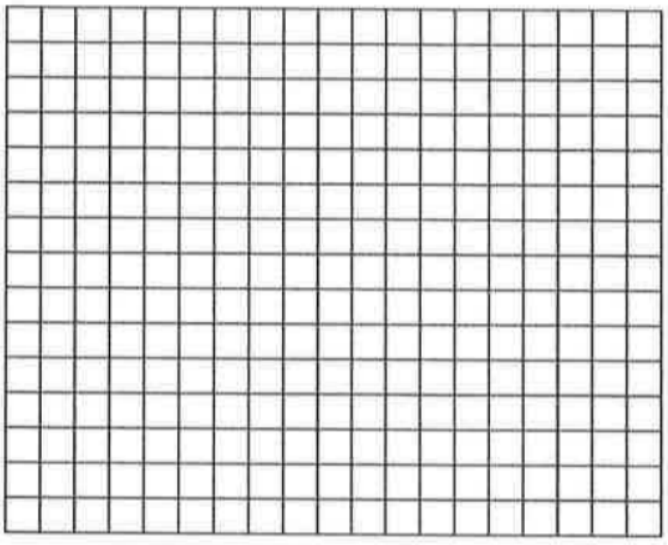
Complete the following: Make sure to show all algebraic steps to get to your final answer.

a. Solve the equation PV = *n*RT for *n.*

b. Solve the same equation for *T.*

c. Solve the same equation for R.

Finally, graphing is a big part of data analysis in chemistry. It is important that you are able to graph relationships properly. In the following provided graph space, graph the function C = 4t-1, where C is on the y axis and t is on the x-axis.



(END OF PART IV)

Part V: States of Matter

https://www.youtube.com/watch?v=bMbmQzV-Ezsj

Investigate each state of matter using the link above. Once your investigation is complete, answer the following questions regarding the properties of each state,

1. In the table below, list the properties of each state of matter, an example of each & sketch a diagram of their particles.

	Solid	**Liquid**	**Gas**
Example			
Particle Diagram			
Properties			

There is a fourth state of matter known as plasma. Use the following resource below. Investigate plasmas and their properties then answer the question listed below.

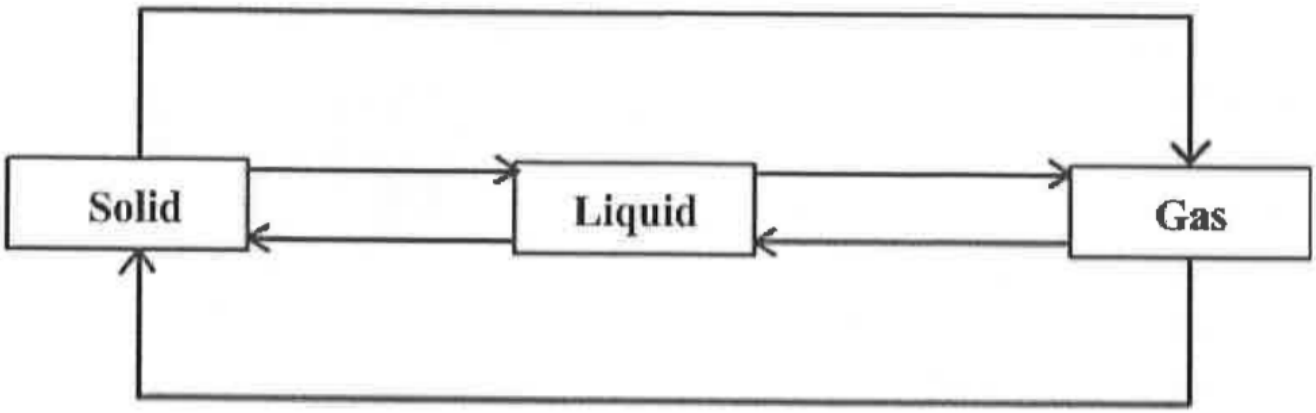
https://www.youtube.com/watch?v=VkeSI_B5Ljc

2. a. Give one example of a natural plasma and one example of a man-made plasma.

b. Plasmas have similar characteristics to what state of matter?

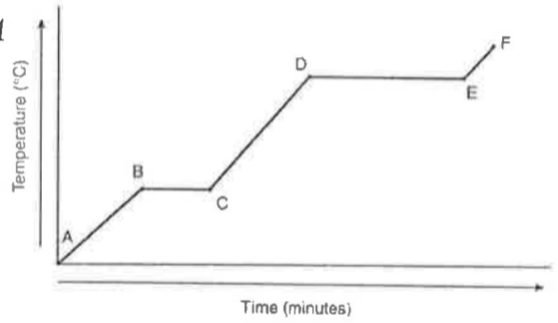
c. Identify what major property of plasmas that is different from the state listed in part b.

Now that you have an understanding of matter and its different states, you will be reviewing state changes. Using prior knowledge and credible sources, label each arrow in the diagram below with the correct name of the process that is occurring. Note: There are six arrows therefore you should have six labels.

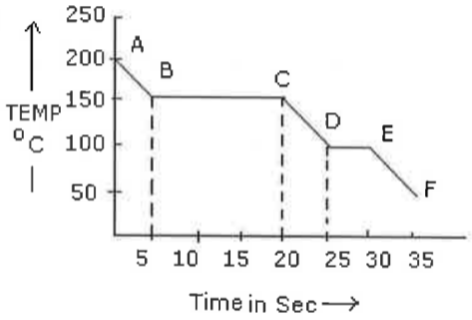


From the integrated science courses that you have completed, heating and cooling curves like the ones shown below may have been discussed. For this assignment, you will be investigating the basic concepts of this graph so that you are prepared to analyze this type of graph in more depth and from a quantitative perspective.

Graph A



Graph B



Answer the following questions based on your knowledge of this graph and what it displays. If this is a concept that you do not recall, you will need to use your resources such as the internet or old materials from integrated science to help you answer the questions below.

3. What state(s) of matter would be observed between point B and C on *Graph A?*

4. Identify which region(s) on *Graph B* where a state change is occurring?

5. Describe temperature as a state change occurs.

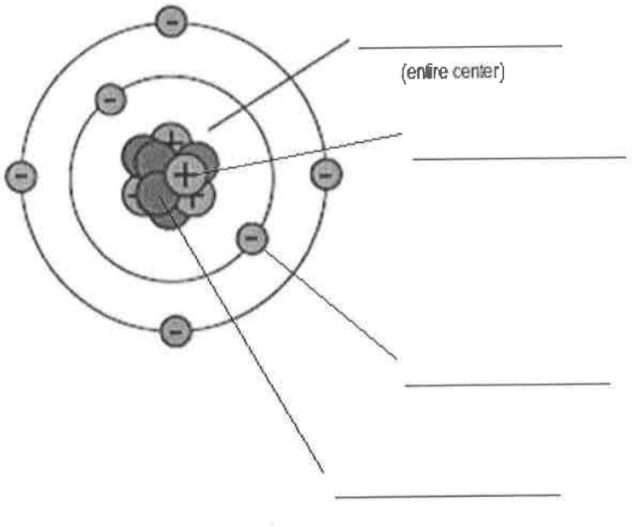
6. At what temperature would the substance in *Graph B* begin freezing?

7. What state of matter is the substance being described in *Graph* A in between points E and F?

END OF PART V

Part VI: Atom Basics

In previous science courses, you learned about the basic components and concepts involving the atom. Understanding of this knowledge is vital for success in this course. We will not be spending time going over the following topics, as we assume you already grasp these concepts. You may however see them incorporated into other content in this class or be asked to recall information to aid in the understanding of our current topic. The atom is the basis of this course. Chemistry concepts build upon one another where we start with our smallest substances and work up to our most complex. To the right, label the components of our atom.



Answer the questions below using the labeled diagram above.

1. The atomic number of an atom =

2. The mass of an atom (mass number) can be determined by:

3. What do the “rings” in the diagram represent*?*

4. What name is given to the electrons located in the outermost“ring”?

5. Why are these electrons significant?

6. If the atom above has 6 protons, 5 neutrons, and 6 electrons:

    a. What is the name of the element this model represents?

    b. What is the overall charge on this atom?

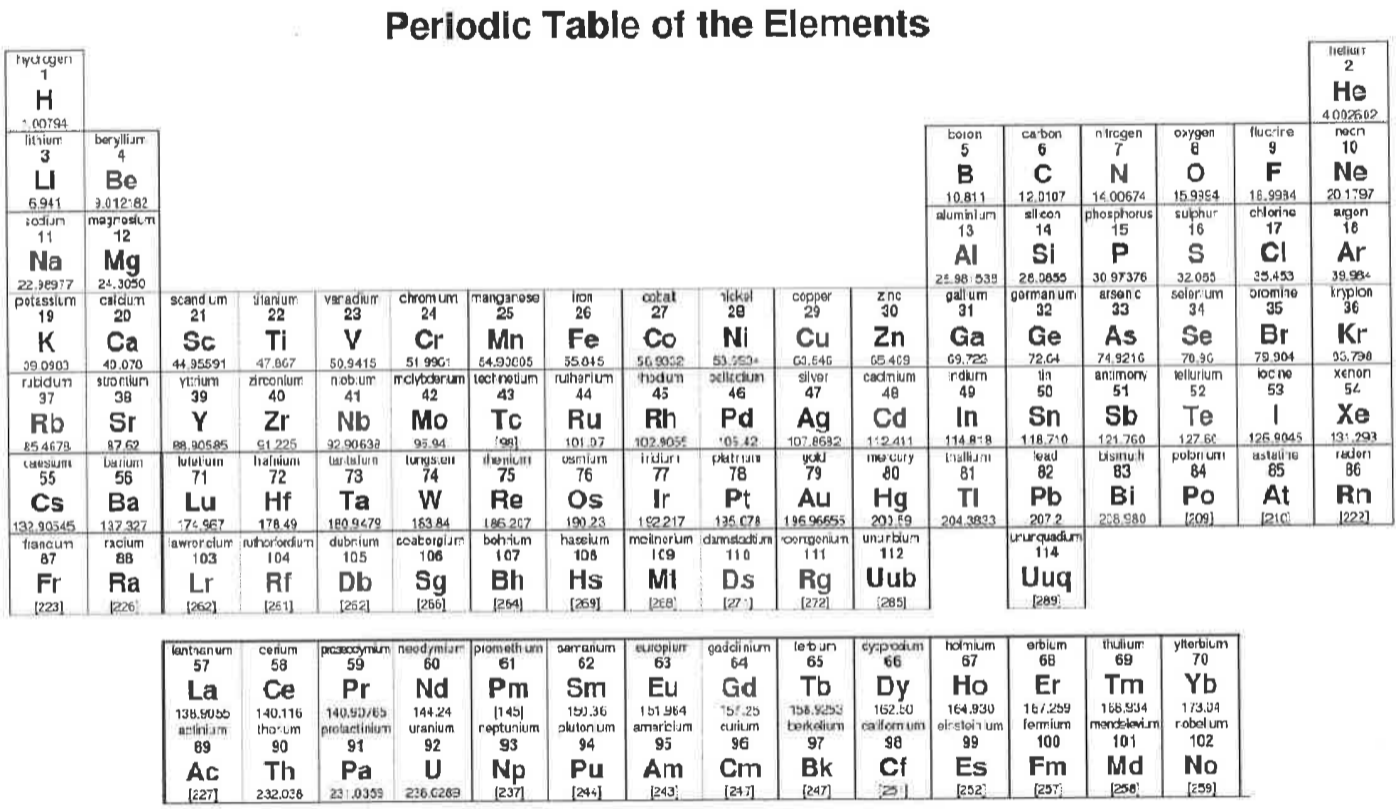
    c. What is the mass of this atom?

END OF PART VI

Part VII: Periodic Table Basics

Similar to the Atom Basics section, we expect from your previous science courses that you have a basic understanding of the Periodic Table. This table is an arrangement of all chemical elements that provides us with an enormous amount of information. We will spend some time looking at the different pieces of information that it tells us beyond what you already know. For now, you should be able to answer the following questions. Once again, if you begin struggling with the content start looking for online resources to help you. I provided a good source to get you started.

http://www.ptable.com/



1. Determine which elements on the periodic table are considered metals. Then, choose a color to shade in the appropriate boxes of the elements that you identified.

2. Determine which elements on the periodic table are considered non-metals. Then, choose a color to shade in the appropriate boxes of the elements that you identified.

3. Determine which elements on the periodic table are considered metalloids (semi-conductors). Then, choose a color to shade in the appropriate boxes of the elements that you identified.

4. Define a metalloid.

5. What are the columns on the periodic table called?

6. What are the rows of the periodic table called? _

7. The majority of the elements on the periodic table are what state of matter at room temperature?

8. What two elements are liquid at room temperature?

9. Although there are many groups on the periodic table, what is the name of the group 18 elements and what is their significance*?*

10. Which of the following would have similar properties to one another and give a brief explanation to how you made this determination?

Magnesium, Calcium, and Barium OR Phosphorus, Sulfur and Chlorine

11. What charge would lithium form when becoming an ion if located in *Group 1?*

12. How many valence electrons does fluorine have in its outermost energy level?

13. If an unknown element has two valence electrons and commonly forms a +2 charge when forming an ion, what is a possibility for its identity*? Hint: There is more than one correct answer.*

14. There are two major types of bonds that occur as these elements combine with other elements on the table; ionic and covalent bonds. Define each of the following below and give an example of each. Use the following link to aid in your responses:

http://www.visionlearning.com/en/library/Chemistry/1/Chemical-Bonding/55

Bondy Type	Definition	Example
Ionic		
Covalent		

END OF PART VII

Part VIII: Lab Equipment & Measurement

Laboratory is a very large component of our chemistry class. You will quickly be learning the set-up, the safety rules, and general operation of the lab when you return to school in the first few days. To save crucial learning time, we are going to introduce you to the different pieces of equipment that you may use at some point in the chemistry lab. Some of the equipment you may be familiar with but most will be brand new. Lab procedures will run more effectively and quicker if you are knowledgeable about what pieces of equipment you are working with, how to use them, and what to use them for. The following section will give you a chance to learn about all the different pieces so that you are ready for lab as the first one approaches in the fall. Using the internet (I recommend finding a pre-made Quizlet on lab equipment). Familiarize yourself with the lab equipment in the table below. You will be required to show knowledge of this equipment during the first week.

Goggles	Funnel
Bunsen burner	Utility clamp
Graduated cylinder	Mortar and pestle
Stir rod	Striker
Evaporating dish	Spatula
Crucible tongs	Wire gauze
Forceps	Test tube rack
Watch glass	Ring stand
Beaker	Erlenmeyer flask
Thermometer	Ring clamp
Crucible and cover	Clay triangle
Test tube clamp	Test tube
Buret	Filter paper
Balance	Hot plate
Dropper pipet or disposable pipet	

END OF PART VIII