

Welcome to Honors Chemistry! In order for you to be prepared to take on the challenges of Honors Chemistry, I have prepared the following assignment for you to complete during the next two months. If you should have any difficulty with any portion of the assignment, please feel free to contact me via email at lisa.cole@bufordcityschools.org

Part 1: Summer Reading

This summer we will be reading *The Andromeda Strain* by Michael Crichton. This book is available at most local bookstores and in the school library. You will be answering questions to support and supplement the reading. These questions will be available on my website on and after June 13. My website can be accessed at the following address:

<http://www.bufordcityschools.org/bhs/teachers/lisacole/index.htm>.

Part 2: Application of Scientific Method

In order to complete this portion of the assignment, you will design and carry out a procedure to investigate different factors that affect the rates of dissolving. The instructions for this assignment are included in this packet.

Part 3: Review of the Fundamentals of Measurement, Problem Solving, and Chemistry

Please complete the following exercises and problems in preparation for next year. The material is general information that you should know from past science courses. In case you have forgotten some of it, I have included general notes and resource materials that should assist you. The material will be reviewed briefly at the beginning of the course in the fall, but the stronger your foundation and the more knowledge you bring to the course, the easier you will find the new material.

The work that you complete in the packet will be collected the first day of class in August and will count as a major grade. Also, be prepared for a quiz over the element symbols and basic math calculations sometime during the first week.

Please do not hesitate to email me at the address above if you have any questions.
Ms. Cole

Application of the Scientific Method

Background: When an effervescent tablet is dropped into a glass of water, a chemical reaction occurs as the tablet dissolves. Design and carry out a procedure to investigate the effects of temperature, surface area, and agitation on the rate of dissolving. A written report will be turned in on the first day of class. This report should include the following:

- A. A specific testable hypothesis for each factor. (Your hypothesis should be specific enough to predict a specific result and written as an “If..., then...” statement.)
- B. A justification for your hypothesis. (This portion of the report should include the facts or previous knowledge that led to your hypothesis.)
- C. An explanation of the procedures you followed in testing each hypothesis.
- D. An organized data table that includes all the data that was collected.
- E. Appropriate graphs of your data.
- F. Identification of the manipulated, responding, and controlled variables in each part of your experiment.
- G. A written conclusion that summarizes your findings. This conclusion should include an acceptance or rejection of each hypothesis, as well as an explanation as to which factor has the greatest affect on the dissolving rate.

Notes: Metric Prefixes and Conversions

tera- (T-)	10^{12}	1 trillion
giga- (G-)	10^9	1 billion
mega- (M-)	10^6	1 million
kilo- (k-)	10^3	1 thousand
hecto- (h-)	10^2	1 hundred
deka- (da-)**	10	1 ten
deci- (d-)	10^{-1}	1 tenth
centi- (c-)	10^{-2}	1 hundredth
milli- (m-)	10^{-3}	1 thousandth
micro- (μ -)	10^{-6}	1 millionth
nano- (n-)	10^{-9}	1 billionth
pico- (p-)	10^{-12}	1 trillionth
femto- (f-)	10^{-15}	1 quadrillionth

Problems:

1. Perform each of the following conversions.
 - A. 8.43 cm to meters.
 - B. 2.41×10^2 cm to meters.
 - C. 294.5 nm to centimeters.
 - D. 1.445×10^4 m to kilometers.
 - E. 235.3 m to millimeters.
 - F. 903.3 nm to micrometers.
 - G. 6.50×10^2 terameters to nanometers
 - H. 1 microgram to picograms
 - I. 25 femtograms to kilograms
 - J. 8.0 dm^3 to liters

Entering very big and very small numbers into your calculator.

Say this... “...times ten to the...”.

Pressing on your calculator is the equivalent of saying “times ten to the”.

So, how do you enter 4×10^5 into your calculator.

You would say this in the following way “4 times ten to the 5”.

You would enter into your calculator the following....

Enter these problems into your calculator...

$$(3.9 \times 10^7) \times (2 \times 10^2)$$

Your answer should be....?

$$(3.9 \times 10^{-7}) \times (2 \times 10^2)$$

Your answer should be....?

$$(-3.9 \times 10^{-7}) \times (2 \times 10^2)$$

Your answer should be....?

Use your calculator to answer the following....

$$(3 \times 10^3) \times (2 \times 10^2) =$$

$$(3 \times 10^3) + (2 \times 10^2) =$$

$$(-3 \times 10^3) / (2 \times 10^2) =$$

$$(3 \times 10^3) - (2 \times 10^2) =$$

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

$$(-3 \times 10^3) \times (2 \times 10^2) =$$

Logic Problems

Chemistry is a branch of science that involves the study of matter and the changes it undergoes. Problem solving and the use of mathematics are important components to the study of chemistry. To expand your mind, you need to learn new facts and develop new ways of thinking that will make the information that you already know more useful. Try to solve the following problems using a combination of world knowledge, mathematics, common sense, logic, and science. Notes: Although some appear to require knowledge of chemistry, most are simply logic problems and can be solved with a limited understanding of the subject.

Logic Problem #1

Among the six molecules below, there are two that are classified as alcohols, two ketones, one aldehyde and one carboxylic acid.

C_3H_6O , $C_2H_4O_2$, CH_4O , C_3H_8O , C_2H_4O , C_4H_8O

Use the following statements to figure out which formulas correspond to which groups (alcohol, ketone, aldehyde or carboxylic acid). Careful: one of the statements below is **FALSE!**

1. Neither CH_4O nor C_4H_8O , which is not an alcohol, is an aldehyde; C_3H_6O isn't either.
2. The carboxylic acid is not C_3H_6O or C_3H_8O .
3. The aldehyde is not $C_2H_4O_2$ or C_3H_8O .
4. C_2H_4O is neither a ketone nor an alcohol.
5. The acidic molecule is neither CH_4O nor C_4H_8O , which is not an alcohol.
6. C_2H_4O is neither an aldehyde nor a carboxylic acid.
7. C_3H_6O is not one of the alcohols.

Logic Problem #2

Dr Beaker has acquired a 12 liter drum of a wonderful new solvent and wishes to share it with Dr Gooch. However, all Dr Gooch has is an empty 8 liter bottle and an empty 5 liter bottle. How can the liquid be divided equally?

Logic Problem #3

A scientist is experimenting with cubic bacteria that are one micrometer in length and that reproduce by dividing every minute into two bacteria. At 12:00 p.m., he puts a single organism in a container. At precisely 1:00 p.m., the container is full. At what time was the container half full? How big (in liters) was the container?

Logic Problem #4

Four particles (kaon, muon, photon, and neutron) belong to four different categories: (baryon, gauge, lepton and meson). Each has a different rest mass (0, 106, 494, and 940). From the statements below, fill out the following table:

Particle	Category	Rest Mass
kaon		
muon		
neutron		
photon		

1. The particle whose rest mass is 106 is not a meson or a baryon.
2. The gauge particle has the lowest rest mass.
3. A kaon is neither a gauge nor a baryon, and its rest mass is not 106.
4. A photon is not a baryon.
5. A neutron's rest mass is not 494. And neither the neutron nor the photon has a rest mass of 106.

Logic Problem #5

Dr Beaker is supervising four students. All the students, named Beryl, Selena, Al and Mo, will produce a compound of a different color; black, white, red or green. One student is working in the organic lab, one in the inorganic lab, one in the physical lab and one in the analytical lab. The building has four floors labeled 1, 2, 3 and 4 and each lab is situated on a different floor.

1. Mo works on an odd numbered floor.
2. The student who made the white compound works in the physical lab.
3. Al works one floor above Mo.
4. The black compound was made on the floor above the white one by Selena, who is an analytical chemist.
5. Beryl works on the floor which is immediately above the organic chemist and immediately below the analytical chemist.
6. The organic chemist has to use the stairs to get to their lab.
7. Al made the green compound and is meeting the inorganic chemist after work.

Can you help Dr Beaker decide which student is in which lab, on which floor and what the color of their compound should be?

Math Skill Activities

1. Use the table below to answer the following questions:

Planet	Average Distance from the Sun (AU)
Mercury	0.39
Venus	0.72
Earth	1.00
Mars	1.52
Jupiter	5.20
Saturn	9.54
Uranus	19.18
Neptune	30.06
Pluto	39.53

- One AU is equal to about 150 million km.

- Which planet has a distance from the Sun that is about 150% of Earth's distance from the Sun?
- How far is Earth from the Sun (in km)?
- Approximately how many times farther from the Sun is Neptune than Jupiter?
- In a chemistry experiment, 8 out of 10 groups got the same results. How is this ratio expressed as a percent?
- Neon gas has a boiling point of -246°C . Xenon gas has a boiling point of -108°C . How much warmer does it have to be for xenon gas to boil than for neon gas?

2. Use your estimation skills to answer the following questions:

- A farmer normally plants 40,000 corn plants on a 5 hectare field. This year she is letting 2 hectares of the field rest and will only plant 3 hectares. How many plants does she need for the 3 hectares?
- In the spring of 1995, the number of California sea otters spotted along the California coast was the highest since the fall of 1982. Approximately 2,400 otters were seen. But, between 1995 and 1998, this number started falling, reaching a low near 1900 by the fall of 1998. If this trend continued, about how many California sea otters would be counted in California in 2004?

3. Apply your measurement skills to answer the following questions:

- A science experiment asks you to measure the pH level of milk. You and your lab partner determine the pH of your sample of milk to be 6.1. The standard accepted pH level of milk is 6.5. Using the formula absolute error = observed value – accepted value, what is the absolute error of this measurement?
- For a chemistry experiment, you collect water in a large beaker. The beaker does not have measurements to tell the volume of water collected. The level rises 4 cm from the bottom of the cylinder and the radius of the cylinder measures 3 cm. Calculate the volume of water in the beaker.

4. Apply your graphing skills and use the information below to complete the following:

The students in a science class performed an experiment to see how temperature and pressure are related. They started with two full plastic bottles of carbonated soft drink. They poured half of one bottle out, and labeled it bottle #1. They labeled the other bottle #2. Then they put one-holed rubber stoppers in the bottles. They inserted a thermometer into the hole of each rubber stopper and measured the temperature in each of the bottles. Each bottle started out at room temperature, 23°C. Then, they shook bottle #1 four times and again recorded the temperatures of the bottles after every four shakes until they had shaken bottle #1 20 times. They did not shake bottle #2. Their data is recorded in the table below.

Total number of shakes of bottle #1	Temperature of bottle #1 (°C)	Temperature of bottle #2 (°C)
0	23	23
4	24	23
8	25	23
12	26	23
16	27	23
20	28	23

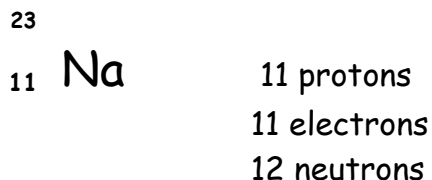
- A. Graph the data on a separate sheet of graph paper. Then, using the graph, explain how temperature and pressure are related in this experiment.
- B. What was the purpose of bottle #2?
- C. Derive an equation that can be used to figure out the temperature of the soda in bottle #1 after x number of shakes (T = temperature).

Fundamentals of Chemistry

Atomic Structure

Notes:

Atoms are made up of three subatomic particles. The proton is positively charged and is located in the nucleus of the atom. The neutron has no charge and is also located in the nucleus. The electron is negatively charged and orbits the nucleus in the empty space surrounding the nucleus of the atom. The atomic number is the number of protons. Since atoms are electrically neutral, the number of protons is equal to the number of electrons. The mass number is the number of particles in the nucleus (the number of protons and neutrons). Isotopes are atoms of the same element having different atomic masses due to differing numbers of neutrons. Isotope symbols, such as the one shown below, are often used to determine the structure of an atom.



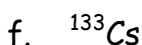
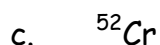
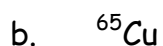
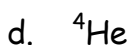
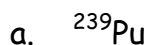
A- mass number = # of protons + # of neutrons

Z- atomic number = # of protons (found on periodic table)

Cations are formed when atoms lose electrons resulting in the atom having a positive charge. Anions are formed when atoms gain electrons which results in a negative charge.

Problems:

1. Give the number of protons and neutrons in the nucleus of each of the following atoms:



2. Complete the following table:

Symbol	Number of protons	Number of neutrons	Number of electrons	Net Charge
$^{238}_{92}\text{U}$				
	20	20		2+
	23	28	20	
$^{89}_{39}\text{Y}$				
	35	44	36	
	15	16		3-

Element Symbols

The following are the names of the elements we will encounter often in class. Becoming familiar with their names and symbols will allow for the completion of assignments more efficiently. Please learn the names and symbols for the elements listed below.

Name of Elements	Elements Symbol & Atomic Number
<u>Aluminium</u>	Al
<u>Antimony</u>	Sb
<u>Argon</u>	Ar
<u>Arsenic</u>	As
<u>Barium</u>	Ba
<u>Beryllium</u>	Be
<u>Bismuth</u>	Bi
<u>Boron</u>	B
<u>Bromine</u>	Br
<u>Cadmium</u>	Cd
<u>Cesium</u>	Cs
<u>Calcium</u>	Ca
<u>Carbon</u>	C
<u>Cerium</u>	Ce
<u>Chlorine</u>	Cl
<u>Chromium</u>	Cr
<u>Cobalt</u>	Co
<u>Copper</u>	Cu
<u>Fluorine</u>	F
<u>Francium</u>	Fr
<u>Gallium</u>	Ga
<u>Germanium</u>	Ge
<u>Gold</u>	Au
<u>Helium</u>	He

<u>Hydrogen</u>	H
<u>Iodine</u>	I
<u>Iron</u>	Fe
<u>Krypton</u>	Kr
<u>Lead</u>	Pb
<u>Lithium</u>	Li
<u>Magnesium</u>	Mg
<u>Manganese</u>	Mn
<u>Mercury</u>	Hg
<u>Neon</u>	Ne
<u>Nickel</u>	Ni
<u>Nitrogen</u>	N
<u>Oxygen</u>	O
<u>Phosphorus</u>	P
<u>Platinum</u>	Pt
<u>Plutonium</u>	Pu
<u>Polonium</u>	Po
<u>Potassium</u>	K
<u>Radium</u>	Ra
<u>Radon</u>	Rn
<u>Rubidium</u>	Rb
<u>Scandium</u>	Sc
<u>Selenium</u>	Se
<u>Silicon</u>	Si
<u>Silver</u>	Ag
<u>Sodium</u>	Na
<u>Strontium</u>	Sr
<u>Sulfur</u>	S
<u>Tellurium</u>	Te
<u>Tin</u>	Sn
<u>Titanium</u>	Ti
<u>Tungsten</u>	W
<u>Uranium</u>	U
<u>Xenon</u>	Xe
<u>Zinc</u>	Zn
<u>Zirconium</u>	Zr

