“Most people say that it is the intellect which makes a great scientist. They are wrong: it is character.” ~Albert Einstein

Summer Reading and Assignment Contract 2024
Bishop O'Gorman High School
College Chemistry

By signing below, you are acknowledging that you have received your summer assignment and agree to the following:

- You will need to complete your summer assignments before the first day of school in August.
- You will be tested over your summer assignments during the first week of school, and these grades will be your first grades for the new school year.
- Students NOT completing the summer assignments may be dropped from College Chemistry.
- You are responsible for your textbook if you take one for the summer; any loss or damage will result in a fine.

PRINTED NAME: ________________________________

SIGNATURE: ________________________________

DATE: ________________________________

EMAIL: ________________________________

PHONE: ________________________________

Dear 2024-25 College Chemistry Student,

Welcome to the amazing world of College Chemistry! I know I have not taught most of you but I have hopefully met you in some shape or form in the past year. I come off as fairly laid back, but there are some things we need to cover about the rabbit hole that you are about to go down. First, the good news: After taking this course you will know how to learn anything, until you reach the 300 level courses of your major you will coast through because you will be such a study monster that it will be effortless to you.

Here are some common misconceptions of students going into College Chemistry:

PERCEPTION: I have always been a “straight A” student and always will be.

REALITY: College Chemistry is challenging. Although there are many “A" grades, there are also “B’s “ C’s “D’s and sometimes “F’s. If your main purpose in taking this class is to collect one more “A”, you are taking the class for the wrong reason. There are easier classes in which to get an “A”.

PERCEPTION: I can miss class (sports, activities, family vacations, jobs, field trips, etc.) and catch up on my own. I always have before.

REALITY: False, You cannot! In College Chemistry, missing class is the number one reason why students fall behind, get lost, give up, and either drop the class or get a low grade. You cannot be gone for three days and expect to get caught up with a 10-minute session after school. I cannot teach in 10 minutes what it took 3 hours to teach earlier. You will need to come in for tutoring and/or make arrangements for alternative assignments to catch up. If I sign an absence form, I expect you to have some dates read and available for catching up. It will be scheduled when the form is *signed*.

PERCEPTION: Mr. Daugaard is making this class a lot tougher than it really needs to be.

REALITY: Never forget… This is a college level course - NOT an advanced high school course. If I am doing my job, students in this course should learn as much as they would if they were taking freshman chemistry at any college or university in the United States. I cannot make the course easier and still accomplish the above goals.

PERCEPTION: All of this work Mr. Daugaard is talking about must be necessary only if I don't pay attention in class. I've never had to study before!

REALITY: Oh, you will study…. All students who expect to be successful in this course will have to spend time after school—either by getting help with an assignment, completing homework, participating in an after school lab, or reviewing for tests. If you are not willing or able to work/study after school to complete chemistry work, you should not take this course! I **WILL** be available almost every day both before and sometimes after school. Students are encouraged to come in for help and to form study groups with peers. Students should expect to spend time outside of class in the study of chemistry most nights. Students who have afterschool jobs or who are heavily involved in after-school activities will have to budget their time accordingly.

You’re welcome for the fair warnings! I don’t mean to scare you: the reality is that this course is amazingly fun. We will dissolve some pennies in acid, play with dangerous chemicals, make pretty colors, and I love memes, so that’s always fun, too. I look forward to seeing you all next year and please keep in mind that you wouldn’t be in this course if I or Miss Wang didn’t think you were up for the challenge!

Summer reading is essential in this course because of the extensive amount of material needed to be covered prior to the College Chemistry ACS test in December for Chem 112 and early May for Chem 114.

All students enrolled in College Chemistry must complete the summer reading assignment which includes:

- Reading and Understanding the material posted in Google Classroom, including the math review section. This is mostly covered in the first two chapters of the book if you choose to check one out for the summer.
  - There are many instructional videos that can aid in reviewing material at http://www.bozemanscience.com/ap-chemistry/.
- Completing the Summer Homework Packet
  - Selected answers for the homework packet are posted on Google Classroom.

The homework packet will be due on the first day of class. All work should be done neatly and clearly. All work for every problem (**including units)** needs to be shown.

This is an expectation on the ACS exams in the winter and spring plus every exam I administer so we want to make this a habit early. **You will be tested over the material in the summer assignment within the first week back.**

You will also need to memorize the list of polyatomic ions and study naming for a **quiz on the second day of class.**

You may need to remain in contact with me during the summer months on your progress through the chapters to ask any questions you may have. THERE WILL NOT BE TIME ON THE FIRST DAY OF CLASS TO ASK QUESTIONS ON THE ASSIGNMENT. You will be able to contact me through my school email ddaugaard@ogknights.org. I will check it periodically throughout the summer.

I look forward to this school year and please do not hesitate to contact me at any time!

Sincerely,

Mr. Daugaard

GOOGLE CLASSROOM CODE: d2cdvk3

AP Chemistry Polyatomic Ions

Ion Symbol	Ion Name
NH_4^+	Ammonium
Hg_2^{+2}	Mercury (I)
CH_3COO^- or $C_2H_3O_2^-$	Acetate
BrO_3^-	Bromate*
CO_3^{-2}	Carbonate*
ClO_3^-	Chlorate*
CrO_4^{-2}	Chromate*
CN^-	Cyanide
$Cr_2O_7^{-2}$	Dichromate
$H_2PO_4^-$	Dihydrogen phosphate
HCO_3^-	Hydrogen carbonate (bicarbonate)
HPO_4^{-2}	Hydrogen phosphate
HSO_4^-	Hydrogen sulfate
OH^-	Hydroxide
NO_3^-	Nitrate*
$C_2O_4^{-2}$	Oxalate
MnO_4^-	Permanganate
O_2^{-2}	Peroxide
PO_4^{-3}	Phosphate*
SO_4^{-2}	Sulfate*

*- ite ending means one less oxygen
*hypo- - ite means two less oxygen
*per- - ate means one more oxygen

Example: Bromate = BrO_3^- Bromite = BrO_2^-
Hypobromite = BrO^- Perbromate = BrO_4^-

Name ___________________________________ Class ______

AP Chemistry Summer Reading Assignment

History of Chemistry & The Atom

Do a quick Google search and shortly describe each of the following's contribution(s) to chemistry.

1. Joseph (JJ) Thomson
2. James Chadwick
3. Robert Millikin
4. Michael Faraday
5. Dmitri Mendeleev
6. John Dalton
7. Henri Becquerel
8. Joseph Proust
9. Antoine Lavoisier
10. Ernest Rutherford
11. Marie Curie

12. Benjamin Franklin

13. Amedeo Avogadro

For each math problem, show all work with unrounded values, labels, and units or no credit will be given. Box or highlight your final numerical answer

Significant Figures & Scientific Notation

1. Count the number of significant figures in the following measurements.

   a. 2.71 g _____ b. 0.00047 kg _____ c. 7.0×10^5 m _____

   d. 1,030 L _____ e. 150 pencils _____ f. 37500 µg _____

2. Express each of the following in proper scientific notation (Pay attention to sig figs and units).
   a. 0.000125 m ________________
   b. 155.0 mL ____________________
   c. 123,030,000 ng ________________
   d. 481.9×10^{-9} cm ________________

3. Express each of the following in long form
   a. 7.30×10^3 ________________
   b. 9.320×10^{-3} ________________

4. Calculate the correct answer with proper units and significant figures for each of the following:
   a. 12 g + 0.7 g + 86.33 g = ______________________
   b. (355.78 g) / (0.056 g) = ______________________
   c. 97.34 mL – 34.1 mL = ______________________
   d. 14.68 x 5 = ______________________

5. Perform the following calculations with scientific notation and report your answer with the correct number of significant figures.
   a. $0.14 \times (6.02 \times 10^{23})$ = ________________________________
   b. $\frac{9.875 \times 10^{4} - 9.795 \times 10^{4}}{9.875 \times 10^{4}} x 100\%$ = ________________________ (assume 100 is exact)
   c. $\frac{3.8 \times 10^{-12} \times 4.0 \times 10^{-13}}{4 \times 10^{12} \times 6.3 \times 10^{13}}$ = ________________________________

Dimensional Analysis

Show work using dimensional analysis. No work = no credit even if the answer is correct. Follow significant figures and rounding rules unless the number of significant figures is specified. Include units where appropriate.Box or highlight your final numerical answer

6. How many hours are in a week? Report your answer to three significant figures.

7. Find the number of centimeters in 1.00×10^2 yards. (1 yd = 3 ft, 1 ft = 12 in, 2.54 cm = 1 in)

8. If Jules Verne expressed the title of his famous book, Twenty Thousand Leagues under the Sea in basic SI units, what would the title be? Round your answer to three significant figures. (1 league = 3.45 mi, 1 mi = 1609 m)

9. How many μL are present in 250 mL of H_2O?

10. Wavelengths are often represented in nm. What is the diameter of a helium (He) atom in nm if it is equivalent to 1.0×10^{-13} km?

11. The separation between carbon atoms in diamond is 0.154nm. How many Angstroms(Å) is this? (1Å = 1×10^{-10}m)

12. The acceleration of a sphere is determined to be 9.52 m/s^2. What is the acceleration in km/min^2?

Physical and Chemical Properties/Changes

13. Decide if the change is Physical (P) or Chemical (C):
    a. ______ Cup of bleach changes a T-shirt from purple to pink.
    b. ______ Water vapor from your breath condenses in air on a cold day.
    c. ______ Plants use carbon dioxide from air to make sugar.
    d. ______ Butter melts when placed in the sun.
    e. ______ Wood burns in an oven.
    f. ______ Iron rusts on a car

14. Categorize each of the following as an element, a compound, or a mixture:
    a. Carbonated water ____________________
    b. Tungsten ____________________
    c. Aspirin (acetylsalicylic acid) ____________________
    d. Air ____________________
    e. Lye (sodium hydroxide) ____________________
    f. Fluorine ____________________

15. What are the physical properties and chemical properties in each?
    a. Calcium carbonate is a white solid with a density of 2.71 g/cm^3. It reacts readily with an acid to produce carbon dioxide.
    b. Gray, powdered zinc metal reacts with purple iodine to give a white compound.

16. A piece of turquoise is a blue-green solid; it has a density of 2.65 g/cm^3 and a mass of 2.5g.
    a. Which observations are qualitative? Quantitative? (Label which is which)
    b. Which observations are extensive? Intensive? (Label which is which)

17. Assume a kernel of popcorn has a mass of 0.125g. After popping its mass is 0.106g. What % of its mass did the kernel lose? How many kernels are in 1 lb (1 lb = 453.6g)?

18. The fluoridation of city water supplies has been practiced in the US for several decades. It is done by adding sodium fluoride to water as it comes from a reservoir. Assume you live in a city of 150,000 people and that 660L of water is consumed per person per day. What mass of NaF in kg must be added to the water supply each year (365 days) to have the required fluoride concentration of 1 ppm (part per million) – 1 kg of fluoride per 1 million kg of water? (NaF is 45.0% fluoride by mass and water has a density of 1.00g/cm^3).

19. In July 1983, an Air Canada Boeing 767 ran out of fuel over central Canada on a trip from Montreal to Edmonton. The pilots knew that 22,300kg of fuel were required for the trip, and they knew that 7682L of fuel were already in the tank. The crew added 4916L of fuel. The crew members used a factor of 1.77 for the fuel density – the problem is that 1.77 has units of pounds per liter and not kg/L. What is the fuel density in kg/L? What mass and volume of fuel should have been loaded? (1lb = 453.6g)

20. Milk in a glass bottle was placed in the freezer overnight. By morning, a column of frozen milk emerged from the bottle. Explain the observation.

21. Write a procedure to find the density of an irregular shaped solid.

22. How could I figure out if a clear, colorless liquid is actually water? How can I figure out if it contains a dissolved substance?

23. Mercury is found as a liquid at room temperature. If it has a boiling point of 630. K, what is this boiling point in degrees Celsius? Farenheit?

24. A rectangular block has dimensions of 2.9 cm x 3.5 cm x 10.0 cm. The mass of the block is 615.0 grams. What is the volume and the density of the block?

25. The density of pure silver is 10.5 g/mL at 20°C. If 5.25 grams of pure silver pellets are added to a graduated cylinder containing 11.2 mL of water, to what volume will the water in the cylinder rise?

26. You can figure out whether a substance floats or sinks if you know its density and the density of the liquid. In which of the liquids listed below will high-density polyethylene, HDPE, float? HDPE, a common plastic, has a density of 0.97 g/cm^3. It does not dissolve in any of the following liquids.

Substance	**Density (g/cm^3)**
ethylene glycol	1.1088
water	0.9997
ethanol	0.7893
methanol	0.7914
acetic acid	1.0492
glycerol	1.2613

27. An unknown piece of metal, with a mass of 2.361g is 2.35cm long, 1.34cm wide, and 1.05mm thick. Based off of the following, which element is it? Nickel (8.91g/cm^3), Titanium (4.50g/cm^3), Zinc (7.14g/cm^3) or Tin (7.23g/cm^3)

28. Which occupies a larger volume, 600g of water (0.995g/cm^3) or 600g of lead (11.35g/cm^3)?

Nuclear Chemistry

29. Give the nuclear symbol ($^{A}{}_{Z}X$) for the following isotopes:
    a. Nickel with 31 neutrons: ___________
    b. Plutonium with 150 neutrons: ____________
    c. Tungsten with 110 neutrons: ___________

30. How many protons and neutrons are contained in the nucleus of each of the following atoms? How many electrons are present in each of these neutral atoms?
    a. $^{13}{}_{6}C$ ____ protons ____ neutrons ____ electrons
    b. $^{208}{}_{82}Pb$ ____ protons ____ neutrons ____ electrons

31. Fill in the missing information regarding the following isotopes

Nuclear Symbol	Hyphen Notation	# of protons	# of electrons	# of neutrons	Mass Number
${}^{12}_{6}C$					
	Oxygen-15				
		92			238
			29	36	

32. Circle/Highlight/Box each of the following are isotopes of element X which has an atomic # of 9.

${}^{19}_{9}X$ ${}^{20}_{9}X$ ${}^{9}_{18}X$ ${}^{21}_{9}X$ ${}^{20}_{8}X$

33. Find the average atomic mass of Mg with the following information:

${}^{24}Mg$: mass = 23.985042amu; percent abundance = 78.99%
${}^{25}Mg$: mass = 24.985837amu; percent abundance = 10.00%
${}^{26}Mg$: mass = 25.982593amu; percent abundance = 11.01%

34. Europium has 2 stable isotopes, ${}^{151}Eu$ and ${}^{153}Eu$, with masses of 150.9197amu and 152.9212amu, respectively. Calculate the percent abundance of these isotopes.

The Periodic Table & Naming

35. These elements start with the letter B: B, Ba, Bk, Bi, and Br. Identify which of these elements match the following descriptions. You may use elements once, more than once, or not at all.

a. Which are metals? ______________________

b. Which are liquids? ______________________

c. Which are actinides? ______________________

d. Which are the main block elements? ______________________

36. Give the symbol and charge for the following ions:

a. Phosphate: ____________

b. Calcium: _________

c. Chloride: _________

d. Bromite: __________

e. Titanium (IV): _________

f. Aluminum: __________

37. Complete the following:

Compound	Cation	# of Cations	Anion	# of Anions
SnO_2				
$PbSO_4$				
$Cr(OH)_3$				

38. Name the following ionic and covalent compounds:

a. $Ca(CH_3COO)_2$ ____

b. $Ni_3(PO_4)_2$ ____

c. P_4S_3 ____

d. $MgCl_2$ ____

e. OF_2 ____

f. NaClO ____

g. $SrSO_3$ ____

h. SO_2 ____

39. Name the following acids:

a. HBr ____

b. HNO_3 ____

c. HNO_2 ____

d. H_2SO_2 ____

e. H_3PO_5 ____

f. HF ____

g. HCl ____

h. $HClO_3$ ____

40. Write the correct formula for the following compounds:

   a. Dinitrogen pentoxide: _________________

   b. Iron (III) oxide: ________________

   c. Potassium permanganate: ______________

   d. Zinc sulfide: _______________

   e. Silver hypochlorite: ______________

   f. Tricarbon octahydride: _______________

   g. Ammonium dichromate: ________________

   h. Lead (IV) sulfite: _______________

41. For each pair of ionic compounds, decide which compound has the strongest Coulombic Attraction:

   a. NaF or NaI: ______________

   b. CaO or NaCl: ____________

   c. AlF_3 or NiF_2: ____________

   d. MgO or MgS: ___________

Balancing Equations & Stoichiometry

42. Balance the following equations using the lowest whole-number coefficients.

   a. ___Fe + ___P_4 → ___Fe_3P_2

   b. ___Ca + ___H_2O → ___$Ca(OH)_2$ + ___H_2

   c. ___$Ba(OH)_2$ + ___H_3PO_4 → ___$Ba_3(PO_4)_2$ + ___H_2O

   d. ___$(NH_4)_2CO_3$ + ___$Al(ClO_3)_3$ → ___$Al_2(CO_3)_3$ + ___NH_4ClO_3

43. Write balanced chemical equations for the following word equations. Use the lowest possible whole-number coefficients to balance the equations.

   a. Aqueous solutions of ammonium sulfate and barium nitrate form a precipitate of barium sulfate and aqueous ammonium nitrate.

   b. Elemental magnesium and oxygen gas combine to form solid magnesium oxide.

   c. Chlorine gas and aqueous potassium bromide react to form bromine liquid and aqueous potassium chloride.

d. Solid copper (II) carbonate decomposes to form crystals of copper (II) oxide and carbon dioxide gas.

e. Sulfuric acid is neutralized by lithium hydroxide to form water and aqueous lithium sulfate.

f. Liquid benzene, C_6H_6, undergoes combustion in oxygen gas, making carbon dioxide gas and steam.

44. Do the following conversions using dimensional analysis:
    a. How many grams are in 2.5 moles of Al?
    b. How many moles of Cu are in 127.08g?
    c. How many molecules are in 9.5g of CO_2?
    d. How many atoms of H are in 4.3 g of H_2O?
    e. How many total ions are in 1.0g of $MgCl_2$?

45. The reusable booster rockets of the U.S. space shuttle employed a mixture of aluminum and ammonium perchlorate for fuel. A possible reaction for this is:

$$\_\_\_Al(s) + \_\_\_ NH_4ClO_4(s) \rightarrow \_\_\_ Al_2O_3(s) + \_\_\_ AlCl_3(s) + \_\_\_ NO(g) + \_\_\_H_2O(g)$$

    a. Balance the above reaction using the lowest possible whole-number coefficients.
    b. If 4.00 g of aluminum reacted completely, how many grams of aluminum oxide would be made?
    c. If 4.18 g of aluminum chloride was produced, how many moles of ammonium perchlorate would be consumed?

d. How many molecules of nitrogen monoxide would form if 6.3×10^{25} formula units of aluminum oxide were also produced?

46. The decomposition of ammonia is shown in the following equation: $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$.

a. 42.0 g of nitrogen has what volume in liters at STP?

b. 150 L of NH_3 undergoes decomposition to form how many liters of hydrogen gas at STP?

c. How many liters of ammonia were decomposed at STP if 3.0×10^{23} nitrogen molecules were made?

47. Give the concentrations of the ions in each of the following solutions:

a. 0.25 M Na_2CO_3

b. 0.61 M $Al_2(SO_4)_3$

48. What volume of $Ca(NaNO_3)_2$ **and** water is needed to prepare 500.0 mL of a 0.250 M $Ca(NaNO_3)_2$ solution from a 2.20 M $Ca(NaNO_3)_2$ solution? (You should have two answers)

49. ___$AlBr_3(aq)$ + ___ $Cl_2(g) \rightarrow$ ___$AlCl_3(aq)$ + ___$Br_2(g)$

If you start with 25.0 mL of a 1.50 M $AlBr_3$ solution, how many liters of Br_2 gas can be produced at STP?

50. What's the molar mass of:

a. $CH_3CH_2CH_2CH_2SH$ ____________ b. $MgSO_4 \cdot 7H_2O$ ________________

51. In 2006, a Russian team discovered an interesting molecule they called "sulflower." It is composed of 57.17%S and 42.83%C and has a molar mass of 448.70g/mol. What is the empirical and molecular formula for this compound?

52. The "alum" used in cooling is potassium aluminum sulfate hydrate, $KAl(SO_4)_2 \cdot xH_2O$. To find the value of x, you can heat a sample of the compound to drive off the water and leave only the anhydrous crystal. Assume you heat 4.74g of hydrated compound and that the sample loses 2.16g of water. What is the value of x?