Dear Student,

Congratulations! You just signed up for one of the most challenging courses at this school. If I personally told you to take it, I believe that you will do well and enjoy doing it. Please make sure that you signed up for this because you LOVE chemistry, not because you don't like biology or the teacher who teaches it, or because you love me (I know, I'm lovable☺). If you do not like chemistry, you are going to find this class impossible.

Below, you will find key terms that I expect you to know and skills you must have from DAY ONE to be successful in this course. If you don't care enough to study a bit over the summer, you should consider a schedule change NOW. They will not let you out once school starts. You are making a commitment when you show up the first day in this class. Make sure you have a completed summer assignment in your hands and are ready to go FIRST DAY!

That being said, this class is awesome! We will have lots of nerdy fun, but understand that it IS nerdy fun, not hang-out fun. Please search your soul, think about how you did in Chem I (if you got a low B or C….consider how much time and effort you want to contribute to improving), think about how much effort you will have to put into this class on top of all of the other classes and activities in which you will be engaged. If you earned a low C or below in Chem I or rarely passed a test, get a schedule change NOW.

You will have homework for me EVERY night. If you choose not to do it, your grade will suffer. If you get behind in here, you will find it very difficult to catch up. The further we go, the more impossible things will get for you if you have not kept up with things. This class is 100% cumulative. All of our topics are inextricably linked to one another. You cannot save up all the homework and practice for the night before the test! That is a recipe for disaster. If that is your usual M.O., it needs to change NOW.

I expect you to KNOW everything you learned in Chem I and this summer assignment is designed to ensure that (don't do it now, space it out throughout the summer to keep your chemistry skills fresh); I expect you to KNOW everything I teach you from Day 1 until May 7, 2020 when you take the AP Exam.

You can earn college credit if you qualify on the AP Exam. Even if you don't qualify, you will gain valuable experience and knowledge in here that will make college chemistry a breeze when you take it. Both of these opportunities are only available to you with MAXIMUM EFFORT in this course.

I do not mean to make you think this course is impossible, but we will be moving at an incredible pace. If you are feeling confused at any point, you must seek help immediately! We may have study sessions on Saturdays on occasion. I can be here before or after school for tutoring. I will do whatever is necessary to make myself available to you for help, but it won't do any good if you don't read the book, watch the video, and work the problems on a daily basis along the way.

Choose wisely. I can't wait to see you on the first day.

FAWCETT☺

Summer Assignment
DO THIS ON YOUR OWN PAPER
NEATLY!!

DUE on the FIRST DAY OF SCHOOL (no exceptions!)
If you did not do it, get a schedule change BEFORE school starts!

You should work on this is small increments over the entire summer. If you waited to do it until the night before school starts, consider a schedule change or a serious reevaluation of your study habits.

1st: Sign up for my remind by texting @alchemist to 81010.

Key terms

Atom, ion, metal, nonmetal, atomic radius, ionization energy, electron configuration, energy level, electron orbital, cations, anions, average atomic mass, isotope, physical change, chemical change (reaction), combustion, single displacement, double displacement, synthesis, decomposition, precipitate, vaporization, empirical formula, molecular formula, mole, molar mass, molarity

Skill Practice (SHOW ALL WORK!!! And put a box around your answer WITH UNITS!) Answer questions in complete sentences.

If you are not willing to show your work, rethink taking this class. If you can't remember how to do something, youtube search (how to…). If you are not willing to do that, rethink taking this class.

Know how to convert between units using dimensional analysis. You may have to look up the conversion factor between the two units.

1. Convert 70.0 mL to L.
2. Convert 590 torr to atm.
3. Convert 25°C to K.
4. Convert 3.7 kg to g.
5. Convert 35.5 mg to g.

Know how to write electron configurations 3 ways.

6. Write the unabbreviated electron configuration for Fe.
7. Write the noble gas configuration for Th.
8. Write the orbital notation for P.

Know your periodic table and trends.

7. Which has the largest radius? K or As?
8. Which has the highest ionization energy? Ar or Kr?
9. Where would you find metals on the periodic table?

10. Where would you find nonmetals on the periodic table?
11. What are columns on the table referred to as and what do they tell you about the structure of an atom?
12. What are rows referred to as and what do they tell you about the structure of an atom?
13. What are elements of the first column called?
14. What are elements of column 17 (VIIA) called?
15. What are elements of column 18 (VIIIA) called and why are they special?

Know how to determine the charge of monatomic ions using the periodic table. KNOW YOUR POLYATOMIC IONS!! Know how to write the formula for a neutral ionic compound.

Polyatomic ions (you memorized these in chem I, LOOK THEM UP AND STUDY THEM AGAIN!)

ammonium = _____

acetate = _____

bromate = _____

chlorate = _____

chlorite = _____

cyanide = _____

hydrogen carbonate = _____

hydroxide = _____

hypochlorite = _____

iodate = _____

nitrate = _____

nitrite = _____

permanganate = _____

perchlorate = _____

thiocyanate = _____

carbonate = _____

chromate = _____

dichromate = _____

oxalate = _____

peroxide =_____

sulfate = _____

sulfite = _____

phosphate = _____

phosphite = _____

arsenate = _____

16. What type of ions do metal atoms typically form?
17. What type of ions do nonmetal atoms typically form?
18. What is the charge of an oxide ion?
19. What is the charge of a magnesium ion?
20. What is the formula for magnesium oxide?
21. What is the formula for aluminum nitrate?
22. What is the formula for potassium permanganate?
23. What is the formula for ammonium sulfate?
24. What is the formula for copper(II) hydroxide?
25. What is the formula for iron(III) sulfide?

Know how to calculate the molar mass, how to convert between g, moles, molecules and atoms; and how to find the empirical and molecular formulas.

26. Glucose has a molecular formula of $C_6H_{12}O_6$.
    a. What is it's empirical formula?
    b. Calculate the molar mass of its molecular formula.
    c. Calculate the molar mass of its empirical formula.
    d. How do the molar masses of the two formulas compare? How do the two formulas compare?

27. A compound is 52.0% Zinc, 9.6% Carbon, and 38.4% Oxygen. Calculate the empirical formula of the compound.

28. A compound is 43.7% Phosphorus and 56.3% Oxygen. The formula mass of the compound is 284 g. Calculate the empirical formula and molecular formula of the compound.

29. How many H atoms are in a 500. g sample of glucose?

30. What is the mass of a sample of Fe_2O_3 containing 5.89×10^{24} Fe^{+2} ions?

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31. Describe the density of particles and compare their kinetic energies for solids, liquids, and gases.

Know how to calculate temperature, volume, and pressure for a changing gas sample. Know how to calculate moles, pressure, volume, temperature for a gas (R=0.0821 L•atm/mol•K).
REMEMBER: Temperature must be in K for gas law formulas!

Formulas you need: combined gas law, ideal gas law, Dalton's law of partial pressures

32. How many moles of gas occupy 98 L at a pressure of 2.8 atmospheres and a temperature of 292 K?

33. If 5.0 moles of O_2 and 3.0 moles of N_2 are placed in a 30.0 L tank at a temperature of 25° C, what will the pressure of the resulting mixture of gases be?

34. A balloon is filled with 35.0 L of helium in the morning when the temperature is 20.0°C. By noon the temperature has risen to 45.0°C. What is the new volume of the balloon?

35. A 35 L tank of oxygen is at 315 K with an internal pressure of 190 atmospheres. How many moles of gas does the tank contain?

36. A balloon that can hold 85 L of air is inflated with 3.5 moles of gas at a pressure of 1.0 atmosphere. What is the temperature in °C of the balloon?

37. $CaCO^3$ decomposes at 1200°C to form CO^2 gas and CaO. If 25 L of CO^2 are collected at 1200°C, what will the volume of this gas be after it cools to 25°C?

38. A helium balloon with an internal pressure of 1.00 atm and a volume of 4.50 L at 20.0°C is released. What volume will the balloon occupy at an altitude where the pressure is 0.600 atm and the temperature is –20.0°C?

39. There are 135 L of gas in a container at a temperature of 260°C. If the gas was cooled until the volume decreased to 75 L, what would the temperature of the gas be?

40. A 75 L container holds 62 moles of gas at a temperature of 215°C. What is the pressure in atmospheres inside the container?

41. 6.0 L of gas in a piston at a pressure of 1.0 atm are compressed until the volume is 3.5 L. What is the new pressure inside the piston?

42. A gas canister can tolerate internal pressures up to 210 atmospheres. If a 2.0 L canister holding 3.5 moles of gas is heated to 1350°C, will the canister explode?

43. The initial volume of a gas at a pressure of 3.2 atm is 2.9 L. What will the volume be if the pressure is increased to 4.0 atm?

44. An airtight container with a volume of 4.25×10^4 L, an internal pressure of 1.00 atm, and an internal temperature of 15.0°C is washed off the deck of a ship and sinks to a depth where the pressure is 175 atm and the temperature is 3.00°C. What will the volume of the gas inside be when the container breaks under the pressure at this depth?

45. Two flasks are connected with a stopcock. Flask #1 has a volume of 2.5 L and contains oxygen gas at a pressure of 0.70 atm. Flask #2 has a volume of 3.8 L and contains hydrogen gas at a pressure of 1.25 atm. When the stopcock between the two flasks is opened and the gases are allowed to mix, what will the resulting pressure of the gas mixture be?

46. A weather balloon has a volume of 35 L at sea level (1.0 atm). After the balloon is released it rises to where the air pressure is 0.75 atm. What will the new volume of the weather balloon be?

Know how to perform calculations for solutions involving mass, volume, and molarity. Be able to explain how to PHYSCIALLY make a solution of desired molarity from a solid or a concentrated stock solution.

REMEMBER: Molarity=mol/L, $M_1V_1=M_2V_2$

47. Calculate the mass of solute needed to make 750. mL of 2.50 M NaCl solution.
48. What mass of $AgNO_3$ must be used to make 200. mL of 0.100 M solution?
49. Describe in detail how you would make 1.25 L of 0.125 M $KMnO_4$ solution if you have solid $KMnO_4$ in stock.
50. How much 18M H_2SO_4 and how much water must be mixed together to make 1.75 L of 6.00 M sulfuric acid?
51. What is the final molarity of the solution if you add 17.00g of SrC_2O_4 and bring to volume of 1.82 L with water, then you take out 15 mL of the initial solution and add it to 77 mL of water?
52. Calculate the molarity of a solution made with 30.0 g of $H_2C_2O_4$ with 500.0 mL of solution.

53. Calculate the molarity of a solution made with 24.2 g of $Cu(NO_3)_2 \bullet 3H_2O$ in 1300 mL. (This is a hydrated salt, the molar mass includes the salt + 3 molecules of water, not multiplication!).
54. If I have a 1.00 M solution of $K_2Cr_2O_7$ and I need to make 750. mL of 0.23 M solution, how do I go about that?

Know how to balance equations AND how to perform stoichiometric calculations based upon it.

- **All of these equations are unbalanced; you must balance them before doing problem!**
- **First: GET TO MOLES, then follow your "map" by cancelling units**
  - **Molar mass**
  - **Molarity and volume**
  - **Volume, temperature and pressure (PV=nRT)**

55. The human body needs at least 1.03×10^{-2} mol O_2 every minute. If all of this oxygen is used for the cellular respiration reaction that breaks down glucose, how many grams of glucose does the human body consume each minute?

$$C_6H_{12}O_6(s) + O_2(g) \text{ -----> } CO_2(g) + H_2O(l)$$

56. In the space shuttle, the CO_2 that the crew exhales is removed from the air by a reaction within canisters of lithium hydroxide. On average, each astronaut exhales about 20.0 mol of CO_2 daily. What volume of water will be produced when this amount of CO_2 reacts with an excess of LiOH?
(Hint: the density of water is about 1.oo g/mL.)

$$CO_2(g) + LiOH(s) \text{ ------> } Li_2CO_3(aq) + H_2O$$

57. At STP (1 atm and 0°C), Carbon monoxide can be combined with hydrogen to produce methanol, CH_3OH. Methanol is used as an industrial solvent, as a reactant in synthesis, and as a clean-burning fuel for some racing cars. If you had 152.5 L CO and 24.50 L H_2,
a) How many kilograms of CH_3OH could be produced? (Hint: this is a limiting reactant problem involving gases!)
b) How many kg of the excess reactant will be leftover?

$$CO(g) + H_2(g) \text{ ------> } CH_3OH(l)$$

58. If 525 mL of 0.80 *M* HCl solution is neutralized with 315 mL of $Sr(OH)_2$ solution what is the molarity of the $Sr(OH)_2$?

$$HCl + Sr(OH)_2 \text{ ------> } SrCl_2 + H_2O$$

59. Huge quantities of sulfur dioxide are produced from zinc sulfide by means of the following reaction.

$$ZnS(s) + O_2(g) \rightarrow ZnO(s) + SO_2(g)$$

If the typical yield is 86.78%, how much SO_2 should be expected if 4897g of ZnS are used?

60. Aspirin, $C_9H_8O_4$, is synthesized by the reaction of salicylic acid, $C_7H_6O_3$, with acetic anhydride, $C_4H_6O_3$.

$$C_7H_6O_3 + C_4H_6O_3 \rightarrow C_9H_8O_4 + H_2O$$

a. When 20.0 g of $C_7H_6O_3$and 20.0g of $C_4H_6O_3$ react, which is the limiting reagent?

b. What mass in grams of aspirin are formed?

61. Dichlorine monoxide, Cl_2O is sometimes used as a powerful chlorinating agent in research. It can be produced by passing chlorine gas over heated mercury (II) oxide according to the following equation:

$$HgO + Cl_2 \rightarrow HgCl_2 + Cl_2O$$

What is the percent yield, if the quantity of the reactants is sufficient to produce 0.86g of Cl_2O but only 0.71 g is obtained?

62. In the commercial production of the element arsenic, arsenic(III) oxide is heated with carbon, which reduces the oxide to the metal according to the following equation:

$$As_2O_3 + C \rightarrow CO_2 + As$$

a. If 8.87g of As_2O_3 is used in the reaction and 5.33 g of As is produced, what is the percent yield?

b. If 67 g of carbon is used up in a different reaction and 425g of As is produced, calculate the percent yield of this reaction.

LOOK AHEAD and PREPARE!

a. Research how to write net ionic equations, practice this!
b. Find "combustion analysis" stoichiometry problems, try a few.