The Hill School

AP Chemistry Name: _____

Summer Preparation Work

Instructions: The summer work for AP Chemistry is reading two chapters from the book and completing the book problems that accompany. In addition to book problems, you will also complete a review of the moles, molar mass, and stoichiometry.

Welcome to AP Chemistry! Our textbook refers to Chemistry as "the central science," since many of the fundamental principles of this science allow students to grasp the nature of the universe, and connect ideas discussed in many other academic realms – biology, physics, math, and beyond.

Enrolling in this college-level, lab-based course means that you have already acquired a solid background in science, including a first-year Chemistry experience, and a comprehension of algebra, fractions, ratios, and scientific notation. Without this knowledge, your progress will be hindered by the need to build these foundational skills while learning new information.

Your teachers therefore ask that you come to the first day of class already familiar with several specific concepts. **You will be tested on these concepts during the first week of class**. To arrive to your year in AP Chemistry well-prepared, you are encouraged to review these materials from your previous Chemistry class. Further, you are required to complete the following assignment in your new AP Chemistry textbook.

Your Textbook: Brown, T., LeMay, H., et al. *Chemistry: The Central Science*. 14th Edition. New York: Pearson, 2018.

ISBN-13: 978-0134414232

Chapter 1: Matter, Energy, and Measurement

(you may read in the textbook, or read the PDF at this link)

Problems (found at the end of the chapter): 1.1, 1.2, 1.13 – 1.16, 1.21 – 1.24, 1.27 – 1.28, 1.31, 1.32, 1.37, 1.49 – 1.51, 1.55 – 1.60, 1.71, 1.92

Chapter 2: Atoms, Molecules, and Ions

(you may read in the textbook, or read the PDF at this link)

Problems: 2.3 – 2.4, 2.7, 2.11 – 2.14, 2.23 – 2.30, 2.41, 2.51, 2.55, 2.61, 2.64, 2.67 – 2.80

Your teachers will be in touch with you this summer, to enroll you in the AP Chemistry Canvas course.

Moles and Molar Mass

This should be a review from the last few days of last year.

Remember that a 1 mole represents Avogadro's number worth of any item. In chemistry, we use it for terms of atoms. So 1 mole is equal to 6.02×10^{23} atoms of any elements, or in terms of whole compounds (H_2O) 1 mole is equal to 6.02×10^{23} molecules of the compound.

Problems:

1. Determine the amount of atoms in 2.3 moles of Iron (Fe).
2. Determine the amount of molecules in 4.5 moles of NaCl.
3. Determine the amount of moles in 6.89 x 10^{23} atoms of Carbon (C)
4. Determine the amount of moles in 3.45 x 10^{24} molecules of H_2O.

Molar mass is the molecular weight of the element or compound. It can be found on the periodic table in the same location as the atomic weight. For compounds, you simply add the total amount of molar mass of the elements that make up the compound. (Recall that the units for molar mass is grams per mole or g/mol)

Ex. H_2O - H is 1.0078 g/mol and O is 15.999 g/mol

(2x1.0078)+15.999 ≈ 18 g/mol

Problems:
Calculate the molar mass of the following species.

1. NaCl
2. $C_2H_8O_3$
3. Fe
4. P
5. C_2Cl_6

5. Stoichiometry

This is an incredibly important skill to learn for chemistry because it is used almost anytime there is a chemical reaction, and in chemistry this happens quite often. It is very similar to making unit conversions, but with stoichiometry instead going from units of the same compound we are now going to different compounds. To do this, we need the **mole ratio**.

The **mole ratio** is the ratio between the coefficients of the compounds within a chemical reaction.
Ex. Take a look at the following equation: $3N_2 + 9H_2 \rightarrow 6NH_3$

So the **mole ratio** for this equation is 3:9:6. This means that for every 3 moles of N_2 and 9 moles of H_2, 6 moles of NH_3 are produced.

Ex. Determine the amount of grams of N_2 required to make 65.3 g of NH_3.

Start with the Givens.
65.3 g NH_3, then convert to moles.

65.3 g NH3$\times \frac{1\ mole\ NH_3}{17\ g\ NH_3}$ = 3.84 mol NH_3 then using the mole ratio, convert to moles of N_2.

3.84 mol $NH_3 \times \frac{3\ mole\ N_2}{6\ mole\ NH_3} = 1.92\ mol\ N_2$, then using the molar mass of N_2, convert to grams.

1.92 mol N_2 $\times \frac{28\ g\ N_2}{1\ mol\ N_2} = 53.76\ g\ N_2$

As one step it looks like this:

65.3 g NH3 $\times \frac{1\ mole\ NH_3}{17\ g\ NH_3} \times \frac{3\ mole\ N_2}{6\ mole\ NH_3} \times \frac{28\ g\ N_2}{1\ mol\ N_2} = 53.76\ g\ N_2$

*Notice how the units cancel until you get to the unit that the question is asking.

Here is a video example.

Problems:

1. $2H_2 + O_2 \rightarrow 2H_2O$
   What type of reaction is this reaction?
   Determine the mole ratio:
   Determine the moles of oxygen gas (O_2) needed to completely react with 1.975 moles of hydrogen gas (H_2).

1. $Na_2CO_3 + CaCl_2 \rightarrow CaCO_3 + 2NaCl$
   What type of reaction is this reaction?
   Determine the mole ratio:

   Calculate the number of moles of sodium chloride (NaCl) formed if 0.345 moles of calcium chloride ($CaCl_2$) react.

1. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
   What type of reaction is this reaction?
   Determine the mole ratio:
   Calculate the number of carbon dioxide (CO_2) molecules produced in the reaction if 0.7525 moles of oxygen gas (O_2) are consumed.

1. $2Ag(NO_3) + Mg \rightarrow Mg(NO_3)_2 + 2Ag$
   What type of reaction is this reaction?
   Determine the mole ratio:
   Determine the mass of magnesium (Mg) needed to react with 0.955 moles of silver nitrate ($AgNO_3$).