

Hello and welcome to AP Chem!

I am so proud of so many of you for wanting to challenge yourself with AP Chemistry. AP Chemistry is my absolute favorite class and I am so excited to meet you all and work with you this year. This is a fast moving class, so I have prepared a review packet of some of the most important pieces of information about chemistry. This packet covers 3 main things, 1- vocabulary, 2-periodic trends, and 3- stoichiometry. **This will be due one week after school starts.** Please do not feel overwhelmed by the length of this packet, a lot of it is worked examples. Completing this will ensure that we can jump right into AP Chemistry work when the school year starts. You are welcome and encouraged to work with others on this packet, but using AI will not help you learn this material. The goal of this packet is to make sure we learn or review some basic chemistry. Links are embedded throughout with videos and resources that I found helpful. If at any point you have any questions or are confused, please email me at elizabeth.fortin@oldham.kyschools.us.

Please use this periodic table to answer any of the questions in part 2 and 3:
<https://apcentral.collegeboard.org/media/pdf/chemistry-periodic-table-2020.pdf>

Vocabulary

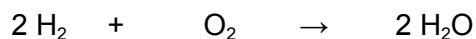
Here are some key terms and main ideas covered in chemistry. I have created a quizlet to help you quiz yourself here: <https://quizlet.com/join-activity?code=AV5SEC> . There are images on the quizlet that I find helpful.

1. Atom: the basic unit of a chemical element.
2. Proton : A subatomic particle that has a positive charge, a mass of 1 amu, and that is found in the nucleus of an atom
3. Neutron: A subatomic particle that has no charge, a mass of 1 amu, and is found in the nucleus of the atom
4. Electron: A subatomic particle that has a negative charge, negligible mass, and is found in the electron cloud outside of the nucleus
5. Molar Mass: The mass of a molecule or compound. This is found by doing Atomic mass * subscript + atomic mass * subscript
6. Atomic symbol: A one or two letter abbreviation for an element
7. Atomic number: The number of protons that an atom has
8. Family/group: A column on the periodic table which all behave similarly due having the same number of valence electrons
9. Period: A row on the periodic table
10. Halogens: A family on the periodic table that is very reactive due to having 7 valence electrons
11. Noble Gases: The final family on the periodic table. Elements in this family are not very reactive due to having a full octet (8 valence electrons)
12. Valence electrons: The electrons in the outermost energy level
13. Covalent bond: A bond where electrons are shared between two nonmetals
14. Ionic bond: A bond where an electron is transferred from a metal to a nonmetal
15. Full octet: Having 8 electrons. This gives the atom stability. All atoms are trying to reach this (*most of the time)
16. Subscript: The small number found after an atomic symbol. This refers only to the element in front of it
17. Coefficient: A number in front of a chemical formula in an equation that indicates how many molecules or atoms of each reactant and product are involved in a reaction.
18. Reactant: The starting atoms or compounds in a chemical reaction
19. Products: The final atoms or compounds in a chemical reaction

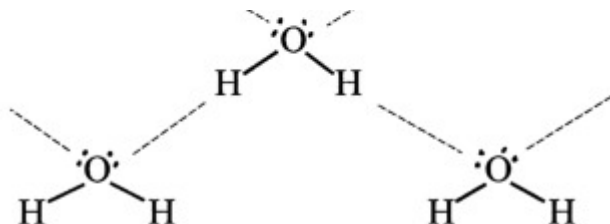
20. Balanced: When there are the same number of each element on both the reactant and product side of the reaction
21. Ionization energy: Energy needed to remove an electron from an atom. This increases moving across a period and decreases moving down a group
22. Electronegativity: A measure of the ability of an atom in a chemical compound to attract electrons. This increases moving across a period and decreases moving down a group
23. Metal: an element that is shiny and that conducts heat and electricity well. This is found on the left side of the periodic table
24. Nonmetal: an element that conducts heat and electricity poorly and is found on the right hand side of the periodic table (and H)
25. Cation: An ion with a positive charge. formed by losing electrons. Metals will form these
26. Anion: an ion with a negative charge, formed by gaining electrons. Nonmetals will form these
27. Intermolecular Forces (IMF): Forces of attraction BETWEEN two molecules
28. Hydrogen bond: An intermolecular force between the hydrogen directly bonded to F, O, or N on one molecule to a F, O, or N on another molecule
29. Dipole-dipole: An intermolecular force between two polar molecules
30. London Dispersion Forces: The intermolecular attractions resulting from the constant motion of electrons and the creation of instantaneous dipoles, this exists between any two molecules
31. Polar: A molecule with one partial positive area and one partial negative area
32. Nonpolar: molecule with no partial charges
33. Mole: the SI base unit used to measure the amount of a substance. 1 mole is equal to 6.022×10^{23} particles. (Think of this like a dozen. 1 dozen= 12. 1 mole= 6.022×10^{23})
34. Mole Ratio: a conversion factor that relates the amounts in moles of any two substances involved in a chemical reaction
35. Avogadro's number: A conversion factor which allows us to convert between moles and number of particles (atoms, ions, molecules)
36. Molarity: A common measure of solute concentration, referring to the number of moles of solute per liter of solution.
37. Ion: an atom with a charge
38. Isotope: Atoms of the same element that have different numbers of neutrons

Vocab Practice

1. Describe the difference between a proton and an electron.
2. Describe the difference between polar and nonpolar molecules.
3. Use the included periodic table and determine if the following elements are metals or nonmetals:
 - a. Carbon:
 - b. Oxygen:
 - c. Calcium:
 - d. Sodium:
4. Label the parts of the following reaction using these terms: reactants, products, coefficients, and subscripts.



5. Is the above reaction balanced?
6. Which intermolecular force is shown below with the dotted lines.



7. Potassium is a metal and will lose an electron in an ionic bond. When this happens, what kind of ion is formed?
8. On the following periodic table, is a family or a period highlighted?

The diagram shows a simplified periodic table. The elements are arranged in a grid. A vertical column of five elements is highlighted in red, representing a chemical family (a group).

Periodic Trends

Please use the ACS handout on periodic trends in order to help you with this assignment: [Mastering Periodic Trends](#)

1. Fill in the chart with increases or decreases

Periodic Trend	Moving down a group	Moving across a period
Electronegativity		
Ionization energy		
Atomic radius		

2. What **Halogen** has the highest electronegativity?
3. What has the **largest** atomic radius:
- Lithium (Li)
 - Beryllium (Be)
 - Sodium (Na)
 - Fluorine (F)
4. Which element is the easiest to remove an electron from (hint first decide which periodic trend I'm referring to)
- Potassium (K)
 - Calcium (Ca)
 - Chlorine (Cl)
 - Sulfur (S)
5. Based on the handout, what is shielding?
6. We add an energy level each period. Does shielding increase or decrease moving down the periodic table?
7. Based on the handout, what is effective nuclear charge? Would the effective nuclear charge increase as the atomic number (number of protons) increases?
8. What **Noble Gas** would have the highest ionization energy and therefore take the most energy to remove an electron from? Make a CER to justify your response. The CER should utilize one of the following terms: shielding, effective nuclear charge, or electron-electron repulsion.

Molar Mass

Molar mass is determined by finding the mass of each element multiplied by the subscript and then added all together.

Ex: CO₂



1. C: $12.01 \times 1 = 12.01$
2. O: $16.00 \times 2 = 32$
3. $12.01 + 32 = 44.01 \text{ g/mol}$

Practice:

1. What is the molar mass of O₂?
2. What is the molar mass of Na₂O?
3. What is the molar mass of H₂O?

Stoichiometry

Stoichiometry is the process of converting from an amount of one chemical compound to another. It is useful in many different areas and types of problems. It will be utilized in every unit. Please start by watching this video (it may be helpful to watch multiple times): [Stoichiometry](#) Another helpful resource: [https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_\(LibreTexts\)/13%3A_A_Solutions/13.08%3A_Solution_Stoichiometry](https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_(LibreTexts)/13%3A_A_Solutions/13.08%3A_Solution_Stoichiometry)

This flow chart can also be helpful (although is cannot be used on tests): [Stoichiometry Flow chart](#)

Example:



Calculate how many grams of iodine are needed to prepare 28.6 grams of ICl by this reaction.

$$28.6 \text{ g ICl} \times \frac{1 \text{ mole ICl}}{162.35 \text{ g}} \times \frac{2 \text{ moles I}_2}{5 \text{ mol ICl}} \times \frac{253.81 \text{ g I}_2}{1 \text{ mol}} = 17.9 \text{ g I}_2$$

1. 100 g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) are dissolved in 2 liters of water. What is the molarity of the solution (hint: first convert grams to moles. Hint: Molarity= moles solute/liters of solution)
2. $5 \text{ KNO}_2 + 2 \text{ KMnO}_4 + 3 \text{ H}_2\text{SO}_4 \rightarrow 5 \text{ KNO}_3 + 2 \text{ MnSO}_4 + \text{K}_2\text{SO}_4 + 3 \text{ H}_2\text{O}$
How many moles and how many grams of KMnO_4 are needed to carry out this reaction on 11.4 grams of KNO_2 ?
3. $\text{NaIO}_3 + 6 \text{ HI} \rightarrow 3 \text{ I}_2 + \text{NaI} + 3 \text{ H}_2\text{O}$
Calculate the number of moles and the number of grams of iodine (I_2) that can be made this way from 16.4 grams of NaIO_3 .
4. $\text{Fe}_2\text{O}_3 + 3 \text{ H}_2 \rightarrow 2 \text{ Fe} + 3 \text{ H}_2\text{O}$
Calculate how many grams of iron (Fe) can be made from 16.5 grams of Fe_2O_3 by the following equation.
5. The combustion of a sample of butane, C_4H_{10} (lighter fluid), produced 2.46 grams of water. How many molecules (particles) of butane were used?
 $2 \text{ C}_4\text{H}_{10} + 13 \text{ O}_2 \rightarrow 8 \text{ CO}_2 + 10 \text{ H}_2\text{O}$