

AP Chemistry Summer packet

Welcome to AP Chemistry. Attached is your summer packet. There should be enough space to do your work on this document but feel free to use additional paper as needed.

I will not be collecting this work but I will check it for completion on the first day for a homework grade. Also, you will have a quiz the first full week of school and a test the second week covering this material. Your Honor's Chemistry notes, and textbook will be helpful. You will need a calculator. I strongly urge you to do a little each week rather than wait until right before school to start. If you have questions, feel free to email me over the summer.

1. Determine if the following substances are made of molecules, atoms, or ions by placing an "X" in the appropriate box.

Substance	Molecules	Atoms	Ions
H ₂ O			
C ₆ H ₁₂ O ₆			
C			
NaCl			
Al			
Al(NO ₃) ₃			

2. Perform the following calculations.
 - a. A 66.0 g sample of a compound contains 36.0 g of C, 6.00 g of H, and 24.0 g of O. Determine the empirical formula.
 - b. A compound contains 0.75 moles of K, 0.75 moles of Cr, and 5.25 moles of O. What is the simplest formula of the compound?
 - c. A compound is made of 12.67% Al, 19.73% N, and 67.60% O. Determine the empirical formula of the compound.

3. In an experiment, a student is assigned the task of determining the number of moles of water in one mole of the hydrate $\text{Na}_2\text{SO}_4 \cdot n\text{H}_2\text{O}$. The student collects the data shown in the following table.

Mass of empty container	22.347 g
Initial mass of sample and container	25.959 g
Mass of sample and container after first heating	24.677 g
Mass of sample and container after second heating	23.941 g
Mass of sample and container after third heating	23.940 g

- a. Explain why the sample was heated three times.

- b. Explain why the student can conclude that all of the water was driven off of the hydrate.

- c. Use the data above to ...
 - i. Determine the mass of the sample before heating.

 - ii. Determine the mass of water in the sample.

 - iii. Determine the moles of water in the sample.

 - iv. Determine the mass of anhydrate in the sample.

 - v. Determine the moles of anhydrate in the sample.

 - vi. Determine the formula of the hydrated compound.

4. Answer the following questions about a 1.745 g sample of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.
- What percent of the hydrate is water?
 - How many grams of water are present in the compound?
 - The sample is placed in a crucible that weighs 22.35 g. The crucible is heated to constant mass. What would be the mass of the crucible and anhydrate?
5. Perform the following calculations.
- How many grams of Cu are in 0.010 moles of CuSO_4
 - How many moles are in 1.80 grams of $\text{C}_6\text{H}_{12}\text{O}_6$ (MM = 180 g/mol)
 - What is the percent composition of Ca in CaF_2 ?
6. Calculate the number of atoms in 5.00 g of ...
- Ca
 - N_2
 - Ne

7. The minimum energy needed to break an oxygen-oxygen bond in ozone is 387 kJ mol^{-1} . Determine the amount of energy needed to break 1 oxygen-oxygen bond in ozone.
8. You have a 2.00 g sample of compounds X, Y, and Z. The molar mass (in g mol^{-1}) of X is 50, Y is 35, and Z is 90. Arrange the compounds from smallest number of moles present to largest number of moles present.
9. Four different metal oxides each have one oxygen. The number of metal atoms in each compound may vary.
- Does the percent of oxygen in the compound increase, decrease, or remain the same as the molar mass of the compound increases?
 - Would a compound with a high percent of oxygen produce more or less oxygen than a compound with a low percent of oxygen?
10. Define the following terms that pertain to electron configuration:
- Shell (energy level)
 - Subshell (sublevel)
 - Core electrons
 - Valence electrons
 - Electron configuration
 - Aufbau principle

11. Give the complete electron configuration of the following atoms and ions.

a. P

b. P^{3-}

c. Mg

d. Mg^{2+}

e. Fe

f. Fe^{2+}

12. Explain why it takes more energy to remove the second electron from Na than it does from Mg.

13. The successive ionization energies of Al are shown below.

14. 1 st ionization energy	15. 2 nd ionization energy	16. 3 rd ionization energy	17. 4 th ionization energy
18. 578 kJ/mol	19. 1820 kJ/mol	20. 2750 kJ/mol	21. 11,600 kJ/mol

a. Explain why the ionization energy jumps when removing the 4th electron.

b. Explain how the ionization energies can be used to determine the number of valence electrons.

22. Define electron affinity.

23. What is the relationship between atom size and electron affinity?

24. What is the relationship between electronegativity and nuclear charge/shielding electrons?

25. What is the most electronegative element? Least electronegative?

26. Use the ionization energies given below to determine the identity of the second period element. Explain your reasoning.

	Ionization Energy (kJ/mol)
First	801
Second	2,430
Third	3,660
Fourth	25,000
Fifth	32,820

27. Write the equation for the ionization of the following elements.

a. Li

b. F

c. Ar

d. Ni

28. Explain why Cl^- is smaller than S^{2-} .

29. Consider the electron configurations shown below:

Element	Electron Configuration
X	$1s^2 2s^2 2p^3$
Y	$1s^2 2s^2 2p^5$
Z	$1s^2 2s^2 2p^6 3s^1$

a. What is the typical charge of an ion of ...

i. Element X

ii. Element Y

iii. Element Z