



2026-2027 Summer Assignment: 11/12 AP CHEMISTRY - Dr. Venkatakrishnan

Dear future AP Chemistry student,

I am excited that you are embarking on your AP Chemistry journey during the 2026-2027 school year.

In preparation for the upcoming school year and this course, I am requiring a summer assignment to support your learning with the following:

1. Reviewing Honors Chemistry topics that set the foundation for AP Chemistry - this assignment goes in order with our units, so if you need a refresher, check your notes or Canvas for the unit from Chemistry.
2. Sharpening up some necessary mathematical skills for AP Chemistry. You must show your work, include units, and round using significant figures.
3. Developing study skills and good habits to set you up for success this school year.

Do not wait until August to review or ask questions! Use your notes and Canvas. If you are really stuck, please email me (venkata@cpsboe.k12.oh.us) and ask a question.

Please complete your summer assignment in hard copy. Have it ready to submit on the first day of class. The summer assignment will count for 50 points of your first-quarter grade. You are required to complete and submit the summer assignment to participate in AP Chemistry. There will be a test in the first full week of class!

Have an excellent summer!

Dr. Venkatakrishnan

Class Preparation

Your first task: Get a 1.5-2" 3-ring binder, a 3-hole punched lined notebook, and pens or pencils (pencils preferred). Bring all of these things in on the first day. They will count as 5 points of this assignment (all or nothing).

[AP Chemistry Reference Sheet](#) (This is printed at the end of the packet)

Part 1: Memorization

Directions: Create a memorization device for each of the following topics. You can use Blooket, Quizlet, or physical flashcards, depending on what helps you memorize most easily.

1. Names of elements

Task: Create flashcards of the **names, families, charges, and valence electrons** for elements 1-20.

2. Common Polyatomic Ions

Task: On the blank periodic table at the end of this review, write the charges (i.e., above the alkali metals column, write "+1"). Label with the family's name. Then, make flashcards for the polyatomic ions below.

3. Prefixes for naming molecular (covalent) compounds – Greek

Task: Memorize the prefixes for 1-10 - no flashcards needed unless helpful. (This is in your Unit 4 notes)

4. Elements that exist as diatomic molecules (Have no Fear!)

Task: Memorize these: H₂ O₂ Br₂ F₂ I₂ N₂ Cl₂

<u>Common Polyatomic Ions</u>					
NH ₄ ¹⁺	ammonium	SO ₃ ²⁻	sulfite	BrO ¹⁻	hypobromite
CN ¹⁻	cyanide	SO ₄ ²⁻	sulfate	BrO ₂ ¹⁻	bromite
CNO ¹⁻	cyanate	C ₂ O ₄ ²⁻	oxalate	BrO ₃ ¹⁻	bromate
SCN ¹⁻	thiocyanate	CrO ₄ ²⁻	chromate	BrO ₄ ¹⁻	perbromate
OH ¹⁻	hydroxide	Cr ₂ O ₇ ²⁻	dichromate	HPO ₃ ²⁻	hydrogen phosphite
HCO ₃ ¹⁻	hydrogen carbonate	PO ₃ ³⁻	phosphite	HPO ₄ ²⁻	hydrogen phosphate
HSO ₃ ¹⁻	hydrogen sulfite	PO ₄ ³⁻	phosphate	H ₂ PO ₃ ¹⁻	dihydrogen phosphite
HSO ₄ ¹⁻	hydrogen sulfate	ClO ¹⁻	hypochlorite	H ₂ PO ₄ ¹⁻	dihydrogen phosphate
C ₂ H ₃ O ₂ ¹⁻	acetate	ClO ₂ ¹⁻	chlorite	BO ₃ ³⁻	borate
NO ₂ ¹⁻	nitrite	ClO ₃ ¹⁻	chlorate	IO ¹⁻	hypoiodite
NO ₃ ¹⁻	nitrate	ClO ₄ ¹⁻	perchlorate	IO ₂ ¹⁻	iodite
MnO ₄ ¹⁻	permanganate	AsO ₃ ³⁻	arsenite	IO ₃ ¹⁻	iodate
O ₂ ²⁻	peroxide	AsO ₄ ³⁻	arsenate	IO ₄ ¹⁻	periodate
CO ₃ ²⁻	carbonate				

<u>Cations with more than one Oxidation State</u>					
Element	Ion	Chemical Name			
Antimony	Sb ³⁺	Antimony (III)	Lead	Fe ³⁺	Iron (III)
	Sb ⁵⁺	Antimony (V)		Pb ²⁺	Lead (II)
Bismuth	Bi ³⁺	Bismuth (III)	Manganese	Pb ⁴⁺	Lead (IV)
	Bi ⁵⁺	Bismuth (V)		Mn ²⁺	Manganese (II)
Chromium	Cr ²⁺	Chromium (II)		Mn ³⁺	Manganese (III)
	Cr ³⁺	Chromium (III)		Mn ⁴⁺	Manganese (IV)
	Cr ⁶⁺	Chromium (VI)		Mn ⁷⁺	Manganese (VII)
Cobalt	Co ²⁺	Cobalt (II)	Mercury	Hg ¹⁺	Mercury (I)
	Co ³⁺	Cobalt (III)		Hg ²⁺	Mercury (II)
Copper	Cu ¹⁺	Copper (I)	Nickel	Ni ²⁺	Nickel (II)
	Cu ²⁺	Copper (II)		Ni ³⁺	Nickel (III)
Gold	Au ¹⁺	Gold (I)	Tin	Sn ²⁺	Tin (II)
	Au ³⁺	Gold (III)		Sn ⁴⁺	Tin (IV)
Iron	Fe ²⁺	Iron (II)	<u>Other Cations</u>		
			Silver	Ag ¹⁺	Zinc Zn ²⁺
			Cadmium	Cd ²⁺	Aluminum Al ³⁺

Part 2: Review of Introduction to Chemistry and Properties of Matter (Units 1 and 2 of Honors Chemistry)

1. A student analyzed a sample for its calcium content and got the following results: 14.92%, 14.91%, 14.88%, and 14.91%. The actual amount of calcium in the sample is 15.70%. Calculate percent error. What conclusion can you draw about the accuracy and precision of these results?
2. How many significant figures are in each of the following?
 - a. 12
 - b. 1098
 - c. 2001
 - d. 2.001×10^3
 - e. 100
 - f. 0.0000101
 - g. 1000.
 - h. 22.04030
 - i. 1.00×10^3
3. Round each of the following numbers to two significant figures, and write the answers in scientific notation.
 - a. 0.00031254
 - b. 31,254,000
 - c. 35,900
 - d. 0.00000399
4. Convert the following Celsius temperatures to Kelvin and to Fahrenheit degrees.
 - a. The boiling-point temperature of ethyl alcohol, 78.1°C
 - b. A cold winter day, -25°C
 - c. The lowest possible temperature, -273°C
 - d. The melting-point temperature of sodium chloride, 801°C
5. What are some of the differences between a solid, a liquid, and a gas?
6. What is the difference between homogeneous and heterogeneous matter?
7. Classify each of the following as homogeneous or heterogeneous.
 - a. soil
 - b. the atmosphere
 - c. a carbonated soft drink
 - d. gasoline
 - e. gold
 - f. a solution of ethanol and water
8. Classify each of the following as a mixture or a pure substance. Of the pure substances, which are elements and which are compounds?
 - a. water
 - b. blood
 - c. table salt (NaCl)
 - d. iron
 - e. brass
 - f. uranium
9. Explain the difference between physical and chemical changes.
10. List four indications that a chemical change (reaction) has occurred.

11. If you place a glass rod over a burning candle, the glass appears to turn black. What is happening to each of the following (physical change, chemical change, both, or neither) as the candle burns? Explain each answer
 - a. the wax
 - b. the wick
 - c. the glass rod
12. The properties of a mixture are typically averages of the properties of its components. The properties of a compound may differ dramatically from the properties of the elements that combine to produce the compound. For each process described below, state whether the material being discussed is most likely a mixture or a compound, and state whether the process is a chemical change or a physical change.
 - a. An orange liquid is distilled, resulting in the collection of a yellow liquid and a red solid.
 - b. A colorless, crystalline solid is decomposed, yielding a pale yellow-green gas and a soft, shiny metal.
 - c. A cup of tea becomes sweeter as sugar is added to it.
13. What is the difference between atomic number and mass number?
14. What is the difference between atomic mass and average atomic mass?
15. What is an isotope?
16. How many protons and neutrons are contained in the nucleus of each of the following atoms?

a. ${}^{42}_{22}\text{Ti}$	d. ${}^{86}_{36}\text{Kr}$
b. ${}^{64}_{30}\text{Zn}$	e. ${}^{75}_{33}\text{As}$
c. ${}^{76}_{32}\text{Ge}$	f. ${}^{41}_{19}\text{K}$
17. The element copper has naturally occurring isotopes with mass numbers of 63 and 65. The relative abundance of the isotopes are 69.2% for mass = 62.93 amu, and 30.8% for mass = 64.93 amu. Calculate the average atomic mass of copper.
18. An element consists of 1.40% of an isotope with mass 203.973 amu, 24.10% of an isotope with mass 205.9745 amu, 22.10% of an isotope with mass 206.9759 amu, and 52.40% of an isotope with mass 207.9766 amu. Calculate the average atomic mass and identify the element.

Part 3: The Periodic Table (Honors Chemistry Unit 3)

19. Write the electron configuration for the following elements.

a. Bromine	c. Barium
b. Nickel	d. Potassium cation (K^+)
20. Distinguish between the terms' family and period in connection to the periodic table. For which of these terms is the term group also used?
21. In the periodic table, what is the name of the following groups?
 - a. Group (2)
 - b. Group (18)
22. An ion contains 50 protons, 68 neutrons, and 48 electrons. What is its symbol and charge?

23. Explain the 4 periodic trends: Ionization energy, Atomic and ionic radii, Electron affinity, and Electronegativity. What patterns do they follow, and why?
24. Would you expect each of the following atoms to gain or lose electrons when forming ions? What ion is the most likely in each case?
- | | |
|-------|-------|
| a. Na | e. I |
| b. Sr | f. O |
| c. P | g. Al |
| d. Ba | h. S |
25. For each of the following ions, indicate the total number of protons and electrons in the ion. For the positive ions, predict the formula of the simplest compound formed between itself and oxide. For the negative ions predict the simplest compound formed between itself and aluminum.
- | | |
|---------------------|---------------------|
| a. Fe^{2+} | e. S^{2-} |
| b. Fe^{3+} | f. P^{3-} |
| c. Ba^{2+} | g. Br^{1-} |
| d. Cs^{1+} | h. N^{3-} |
26. An element's most stable ion forms an ionic compound with bromine, having the formula XBr_2 . If the ion of element X has a mass number of 230 and 86 electrons, what is the identity of the element, and how many neutrons does it have?

Part 4: Bonding and Intermolecular Forces (Unit 4 of Honors Chemistry)

Try this WITHOUT an ion chart! You need to have these memorized.

27. Name each of the following compounds:
- | | | |
|---------------------------------|--------------------------------------|---------------------------|
| a. HgO | e. NaHCO_3 | i. Ca(OH)_2 |
| b. CuI | f. $\text{HC}_2\text{H}_3\text{O}_2$ | j. CaSO_3 |
| c. $\text{Pb}_3(\text{PO}_4)_2$ | g. NH_4NO_2 | k. S_3N_4 |
| d. Na_2CrO_4 | h. NH_4NO_3 | l. SF |
28. Write the formula for each of the following compounds:
- | | | |
|------------------------|--------------------------|------------------------------|
| a. Sodium oxide | e. Copper (I) chloride | i. Lead (IV) sulfide |
| b. Sodium peroxide | f. Lead (II) sulfide | j. Sodium sulfate |
| c. Potassium cyanide | g. Zinc sulfide | k. Aluminum hydrogen sulfate |
| d. Copper (II) nitrate | h. Silicon tetrafluoride | |
29. Classify the following substances as metallic, covalent molecules or ionic compounds:
- | | |
|------------------|-------------------|
| a. MgO | d. CuS |
| b. LiCl | e. XeF_4 |
| c. NI_3 | f. NO_2 |
30. How many valence electrons do the following atoms or ions have?
- a. O^{2-}
31. Draw the Lewis dot structures for the following molecules – then, list the electron geometry, molecular geometry, and then indicate whether the molecule has a dipole moment.
- | | |
|-------------------------|------------------|
| a. H_2O | c. NH_3 |
| b. SiCl_4 | d. CO_2 |

Part 5: Chemical Reactions (Unit 5 of Honors Chemistry)

32. Balance the following equations:

- a. $\text{___CO} + \text{___O}_2 \rightarrow \text{___CO}_2$
- b. $\text{___N}_2\text{O}_5 + \text{___H}_2\text{O} \rightarrow \text{___HNO}_3$
- c. $\text{___PCl}_5 + \text{___H}_2\text{O} \rightarrow \text{___H}_3\text{PO}_4 + \text{___HCl}$
- d. $\text{___CH}_4 + \text{___Br}_2 \rightarrow \text{___CBr}_4 + \text{___HBr}$
- e. $\text{___C}_5\text{H}_{10}\text{O}_2 + \text{___O}_2 \rightarrow \text{___CO}_2 + \text{___H}_2\text{O}$
- f. $\text{___AgNO}_3 + \text{___K}_2\text{SO}_4 \rightarrow \text{___Ag}_2\text{SO}_4 + \text{___KNO}_3$

33. Write balanced chemical equations to correspond to each of the following descriptions.

- a. When liquid phosphorus trichloride is added to water, it reacts to form aqueous phosphorous acid, and hydrochloric acid.

- b. Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.

34. Indicate what type of reaction is represented in the following equations.

A. Synthesis B. Decomposition C. Single replacement D. Double replacement E. Combustion

- a. $\text{___H}_2 + \text{I}_2 \rightarrow 2\text{HI}$
- b. $\text{___Aluminum} + \text{iron (III) oxide} \rightarrow \text{aluminum oxide} + \text{iron}$
- c. $\text{___2C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$
- d. $\text{___AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
- e. $\text{___Hydrochloric acid} + \text{ammonia} \rightarrow \text{ammonium chloride}$
- f. $\text{___2NaClO}_3 \rightarrow 2\text{NaCl} + 3\text{O}_2$
- g. $\text{___2Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
- h. $\text{___Methane} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$

Part 6: Stoichiometry (Unit 6 of Honors Chemistry)

35. The molecular formula of aspartame, the artificial sweetener marketed as NutraSweet, is $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5$.

- a. What is the molar mass of aspartame?

- b. How many moles of aspartame are present in 3769.4 g of aspartame?

- c. How many molecules of aspartame are present in 345.9 g of aspartame?

- d. How many oxygen atoms are present in 23.6 g of aspartame?

36. How many moles of ammonium ions are in 0.557 g of ammonium carbonate?

37. What is the mass, in grams, of 0.0438 moles of iron (III) phosphate?

38. What is the mass, in grams, of 2.69×10^{23} molecules of aspirin, $\text{C}_9\text{H}_8\text{O}_4$?

39. What is the molar mass of diazepam (Valium) if 0.05570 mol has a mass of 15.86 g?
40. Determine the empirical formulas of the following compounds. (EF is 4 steps; 1-Find the mass, 2-Find the moles, 3-Divide by small, 4-Multiply). until whole)
- 10.4 % C, 27.8 % S, and 61.7% Cl
 - Monosodium glutamate (MSG), a flavor enhancer in certain foods, 35.51 g C, 4.77 g H, 37.85 g O, 8.29 g N, 13.60 g Na
41. Find the molecular formulas of the following compounds. ($\text{MF}_{\text{mass}}/\text{EF}_{\text{mass}} = n$, then $\text{MF} = n(\text{EF})$) Hint: You must find EF first
- 73.8% carbon, 8.7% hydrogen, 17.5% nitrogen, molar mass = 166.0 g/mol
 - 80.0% carbon, 20.0% hydrogen, molar mass = 30.0 g/mol
42. $4\text{FeCr}_2\text{O}_7 + 8\text{K}_2\text{CO}_3 + \text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 + 8\text{K}_2\text{CrO}_4 + 8\text{CO}_2$
- How many grams of FeCr_2O_7 are required to produce 44.0 g of CO_2 ?
 - How many grams of O_2 are required to produce 100.0 g of Fe_2O_3 ?
 - If 300.0 g of FeCr_2O_7 reacts, how many grams of O_2 will be consumed?
 - How many grams of Fe_2O_3 will be produced from 300.0 g of FeCr_2O_7 ?
 - How many grams of K_2CrO_4 are formed per gram of K_2CO_3 used?
43. Silver nitrate and aluminum chloride react with each other by exchanging anions:
- $$\text{AgNO}_3 + \text{AlCl}_3 \rightarrow \text{Al}(\text{NO}_3)_3 + \text{AgCl}$$
- What mass of AgCl is produced when 4.22 g of AgNO_3 reacts with 7.73 g of AlCl_3 ? The reaction must be balanced.

44. Write the net ionic equations for the following
- Aqueous solutions of magnesium nitrate and sodium bromide are mixed.
 - A solid aluminum metal strip is immersed in a solution of silver nitrate.

Part 7: Energy and Gas Laws (Unit 7 of Honors Chemistry)

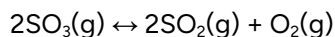
45. What is the unknown gas if you have 7.0 grams of it in a 2.0 L inflexible container at a temperature of 52.0 °C and a pressure of 1.12 atm?
46. A 5.0 L flask contains 1.50 g CO₂ at a temperature of 44 °C. What is the pressure in atm?

Part 8: Acids, Bases, and Solutions (unit 8 of Honors Chemistry)

47. Write the strong acids and bases below.

Part 9: Kinetics and Thermodynamics (unit 9 of Honors Chemistry)

48. Explain the kinetic molecular theory and how temperature change impacts energy of molecules.
49. Using Le Chatelier's principle, what would happen to the position of the equilibrium when the following changes are made to the equilibrium system below?



- Sulfur dioxide is added to the system.
- Sulfur trioxide is removed from the system.
- Oxygen is added to the system.

Part 10: Organic Chemistry (Unit 10 of Honors Chemistry)

50. Lucky you - there is no Organic Chemistry on the AP Chemistry exam 😊 Sit back and relax!

CONGRATULATIONS, you made it! Be proud of yourself, and get ready for a fun-filled, challenging year that will push you to your limits, make you a better student, get you prepared for college, and prove to yourself how brilliant you really are! Remember, I am on your side and will work with you to develop the tools to succeed. You got this! - Dr. V