

# AP Chemistry 2022 Summer Practice

Dear Future AP Chemistry student,

I'm excited that you are thinking about taking AP Chemistry in the 2022-2023 school year with me and I am so happy that I have an opportunity to teach you! This is a hard class that requires dedication, a fair amount of work, and a love for chemistry. Many AP classes represent just one semester of coursework (like AP Government), but AP Chemistry represents two full semesters of college coursework, so we will be learning as fast as students do in college. I know that with your passion and effort, we'll have a great time learning this advanced material in chemistry.

AP Chemistry is meant to be a second-year course for students who were successful in 1<sup>st</sup> year Chemistry. Because we do have so much to learn next year and because Chemistry is comprehensive, I've put together this packet for you to complete during the summer, due the first Friday after school begins. The packet is primarily focused on basic atomic theory, naming compounds, and dimensional analysis. We will be re-learning most first year topics- though at a quicker pace and in more depth - but the topics in the summer assignment will not be reviewed. I have provided useful, but not required, video links and textbook pages to aid in your understanding.

A quiz over the summer assignment will be given the first Friday after school begins. A test over Ch.1 and 2 of the textbook, Brown and LeMay "Chemistry: The Central Science", will be given at the beginning of the second week of school, including material taught in class the first week as well as material from the summer assignment.

## Instructions for the Summer Assignment: (COPIES available in E122 until the last day of school)

1. Read the assigned textbook pages (video links are optional)
  - Our textbook with examples is online here: [Brown & Lemay: The Central Science](#)
2. Work in blue or black pen or pencil on this document directly.
3. Correct your work in green or red pen using the answer key posted on Teams at the very end of summer break or the beginning of the school year (when students are added to our Teams). As long as your work OR the corrections are correct, you will receive full credit. No corrections will not receive full credit.
4. Use resources to help you including our online textbook, your notes from Honors/ASP/On Level Chemistry, links provided, and other science gurus on the web including: Tyler DeWitt, Bozeman Science, Professor Dave, Crash Course, Khan Academy, and more.
5. Be sure to memorize the polyatomic ions in bold at the end of this packet. (Making flashcards is very useful!) A quiz over polyatomic ions will be given the first Wednesday after school begins.
6. The assignment is due the first Friday that school is in session, Aug. 12.

AP Chemistry includes a lot of problems solving and deep conceptual understanding, but the summer assignment is primarily focused on more rote foundational skills. Mastering chemical nomenclature (naming and formula writing) especially, will allow us to move on to other topics – we have a lot to learn!

I recommend taking several weeks off in summer to enjoy other things like reading, going outside, watching movies, seeing friends, and engaging in hobbies. A mental break is so important as we will have a lot to do next year. I would suggest starting the summer assignment in the last couple of weeks before school starts, but you find what works best for you, depending on your schedule. Studies show that learning happens best when learning is not all done at once but done over time, so doing one part/day might be a good plan.

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Checklist of things you should know after completing this packet:

\_\_\_\_\_ what was learned about the atom through basic discoveries (Dalton, Thomson, Millikan, Rutherford)

\_\_\_\_\_ the spelling and symbols of the common elements (attached at the end)

\_\_\_\_\_ how to read or determine the following information on the periodic table

- atomic number
- average atomic mass
- most common oxidation state (charge)

\_\_\_\_\_ how many protons, neutrons, and electrons are in a given isotope or ion using a periodic table

\_\_\_\_\_ how to name and write the formulas for binary (two elements) ionic and covalent compounds and ternary (three or more elements) ionic compounds: **spelling counts for names, capitalization counts of formulas**

- prefixes for covalent only
- when to use roman numerals (Sn, Sb, Pb, and transition metals, but not for Ag, Zn, and Cd)
- when to use – ide, -ite, or -ate at the end of a compound

\_\_\_\_\_ **the spelling and symbols of the polyatomic ions (attached)**

\_\_\_\_\_ how to name and write the formulas for acids

\_\_\_\_\_ how to name and write formulas for the first 10 alkanes, alkenes, alkynes, and alcohols

\_\_\_\_\_ dimensional analysis to convert from one unit to another, especially using metric units:

- m, L, g, as base units
- pico, nano, micro, milli, centi, kilo as prefixes
- $\text{cm}^3$ , mL, for volume

Name \_\_\_\_\_ Period \_\_\_\_\_

## Part 1: The Basics about the Atom and the Discoveries (Read 2.1 – 2.3 of online textbook)

My own videos on parts of the atom from my Unit 0 Notes (provided when school starts): [https://screencast-o-](https://screencast-o-matic.com/watch/cYjDqLGHCC)

[matic.com/watch/cYjDqLGHCC](https://screencast-o-matic.com/watch/cYjDqLGHCC)

History of the Atom: [https://www.youtube.com/watch?v=njGz69B\\_pUg](https://www.youtube.com/watch?v=njGz69B_pUg)

Early Atomic Models: [https://www.youtube.com/watch?v=ajQEvtge0m0&feature=emb\\_title](https://www.youtube.com/watch?v=ajQEvtge0m0&feature=emb_title)

Rutherford's Gold Foil Experiment: [https://www.youtube.com/watch?v=sNQsdrqsD\\_s](https://www.youtube.com/watch?v=sNQsdrqsD_s)

(Important Video!) Parts of the Atom: <https://www.youtube.com/watch?v=h6LPAwAmnCO>

### 1. Match the scientist with discovery

\_\_\_\_\_ Proposed that atoms exist, but didn't know about subatomic particles (protons, neutrons, or electrons), isotopes, or radioactivity

\_\_\_\_\_ Used cathode rays to discover the existence of electrons

\_\_\_\_\_ Used the oil drop experiment to determine the mass of an electron

\_\_\_\_\_ Shot alpha radiation at gold foil and discovered the nucleus

\_\_\_\_\_ Discovered the nucleus was very dense, contained protons

\_\_\_\_\_ Discovered that electrons weighed about 2,000x less than a proton

\_\_\_\_\_ Discovered that while almost all of the mass is in the nucleus, most of the volume is empty

\_\_\_\_\_ Discovered the neutron

- A. Dalton
- B. Thomson
- C. Millikan
- D. Rutherford
- E. Chadwick

### 2. Match the part of the atom with the description

\_\_\_\_\_ and \_\_\_\_\_ Weighs approximately 1 amu, or 1 u

\_\_\_\_\_ Weighs about 2,000 times less than a proton, or 0.005 u

\_\_\_\_\_ Has a positive charge

\_\_\_\_\_ Has a negative charge

\_\_\_\_\_ Has no charge (neutral)

\_\_\_\_\_ and \_\_\_\_\_ Located in the nucleus

\_\_\_\_\_ and \_\_\_\_\_ Included in the mass number of an isotope

\_\_\_\_\_ The number of these in an atom define the element

\_\_\_\_\_ Included in the atomic number

\_\_\_\_\_ and \_\_\_\_\_ The number of these can vary for a given element

- A. proton
- B. neutron
- C. electron

### 3. True or False?

\_\_\_\_\_ When you weigh an atom, you are essentially weighing the nucleus.

\_\_\_\_\_ Most of the (volume of an) atom is empty space.

\_\_\_\_\_ Besides protons, neutrons, and electrons, nothing else is in the atom.

\_\_\_\_\_ All atoms with 9 protons are fluorine.

\_\_\_\_\_ All fluorine atoms have 9 protons.

\_\_\_\_\_ A fluorine atom with more or less than 9 electrons is an ion.

\_\_\_\_\_ Atoms of the same element that have different weights are called isotopes.

\_\_\_\_\_ Atoms with different numbers of neutrons but the same number of protons are called isotopes.

## Part 2: How many protons, neutrons, and electrons are in an isotope or ion? (Read 2.3, 2.4)

How to Calculate the Number of protons, neutrons, and electrons in an atom: <https://www.youtube.com/watch?v=65dDZulPhtg>

My own video on isotopes and ions: <https://screencast-o-matic.com/watch/cYjDYQGHmi>

You should use a periodic table to complete the table below. Assume the species are neutral unless told otherwise.

	element	Metal? Nonmetal? Metalloid?	Z (atomic #)	A (mass #)	# protons	# neutrons	# electrons	Isotopic symbol
1.	lithium - 6			6				
2.			3	7				
3.	silicon - 30					16		
4.			92	235				
5.	chlorine-37			37				
6.	silver- 108			108				
7.					29	35		
8.								$^{196}_{79}\text{Au}$
9.								$^{208}_{82}\text{Pb}$
10.	hydrogen - 2 (deuterium)		1	2				
11.					1	2	1	
12.	tungsten - 183							
13.	radon - 223							
14.			7	15				
15.			5	10				
16.						69	51	
17.					50	69		
18.	oxygen-16					8	10	$^{16}_8\text{O}^{2-}$
19.	potassium-39					20	18	$^{39}_{19}\text{K}^+$
20.	nitrogen-14					7	10	$^{14}_7\text{N}^{3-}$

### Part 3: Binary Ionic Compounds (Compounds with a metal and a nonmetal) (Read 2.5, 2.7)

Common Elements: <https://quizlet.com/220422237/50-common-elements-flash-cards/>

Binary Ionic Compounds Quizlet: <https://quizlet.com/147016604/naming-binary-ionic-compounds-flash-cards/>

Naming Ionic Compounds with Transition Metals: <https://www.youtube.com/watch?v=8KSWRy2MMYm>

Quizlet Practice: Ionic Compounds with Transition Metals: <https://quizlet.com/147016762/unit-5-naming-ionic-compounds-with-transition-metals-roman-numerals-flash-cards/>

#### Data Table 1.

- These three transition metals charges do not vary so **do not** get a roman numeral.  
(zinc)  $Zn^{2+}$                       (silver)  $Ag^+$                       (cadmium)  $Cd^{2+}$
- These three metals are **NOT** transition metals but **DO** get roman numerals  
Tin (Sn)                      Antimony (Sb)                      Lead (Pb)

I. For the following elements, state if it is on the left side or right side of the zig-zag line that separates metals from nonmetals on the periodic table. Then, give the symbol of the ion formed. (*Elements on the left side will always have positive charges as ions, elements on the right side will always have negative charges, or a zero charge if a noble gas*)

	Left/right?	Ion symbol		
1. lithium	<u>left</u>	$Li^+$	11. tin (IV)	_____
2. sulfur	_____	_____	12. gallium	_____
3. chlorine	_____	_____	13. selenium	_____
4. fluorine	_____	_____	14. nitrogen	_____
5. barium	_____	_____	15. copper (I)	_____
6. magnesium	_____	_____	16. copper (II)	_____
7. titanium (II)	_____	_____	17. antimony (V)	_____
8. aluminum	_____	_____	18. zinc	_____
9. phosphorus	_____	_____	19. silver	_____
10. potassium	_____	_____	20. helium	_____
			21. tungsten (VI)	_____

II. Write the correct chemical formula for each of the following ionic compounds.(capitalization matters)

1. lithium sulfide	_____	11. silver bromide	_____
2. nickel (III) fluoride	_____	12. antimony (III) oxide	_____
3. barium phosphide	_____	13. gallium chloride	_____
4. sodium phosphide	_____	14. calcium iodide	_____
5. cobalt (III) bromide	_____	15. strontium arsenide	_____
6. magnesium arsenide	_____	16. aluminum oxide	_____
7. zinc nitride	_____	17. iron (III) telluride	_____
8. mercury (II) iodide	_____	18. nickel (II) bromide	_____
9. cesium fluoride	_____	19. tin (II) nitride	_____
10. chromium (II) sulfide	_____	20. lead (IV) hydride	_____

III. Write the correct name for each of the following ionic compounds. (**spelling matters**)

- |                      |       |                                    |       |
|----------------------|-------|------------------------------------|-------|
| 1. Cs <sub>2</sub> S | _____ | 10. AgCl                           | _____ |
| 2. BeS               | _____ | 11. Al <sub>2</sub> S <sub>3</sub> | _____ |
| 3. CoCl <sub>2</sub> | _____ | 12. K <sub>3</sub> N               | _____ |
| 4. Cu <sub>2</sub> S | _____ | 13. CrO                            | _____ |
| 5. SnF <sub>2</sub>  | _____ | 14. Fe <sub>2</sub> S <sub>3</sub> | _____ |
| 6. NaF               | _____ | 15. HgCl <sub>2</sub>              | _____ |
| 7. LiH               | _____ | 16. Sb <sub>3</sub> P <sub>2</sub> | _____ |
| 8. RaO               | _____ | 17. CdI <sub>2</sub>               | _____ |
| 9. PbS <sub>2</sub>  | _____ | 18. MnF <sub>4</sub>               | _____ |

### Part 4: Binary Covalent Compounds (Compounds with only nonmetals) (Read 2.6)

Naming Covalent Compounds: <https://www.youtube.com/watch?v=DejkvR4pvRw>

Binary Covalent Compounds Quizlet: <https://quizlet.com/147016284/naming-binary-covalent-compounds-flash-cards/>

#### Data Table 2. Prefixes used for Covalent Compounds.

Number	Prefix	Number	Prefix
1	mono-	6	hexa-
2	di-	7	hepta-
3	tri-	8	octa-
4	tetra-	9	nona-
5	penta-	10	deca-

I. Write the correct formula for each of the following molecular (covalent) compounds. (**capitalization matters**)

- |                          |       |                             |       |
|--------------------------|-------|-----------------------------|-------|
| 1. dichlorine monoxide   | _____ | 6. phosphorus pentachloride | _____ |
| 2. silicon dioxide       | _____ | 7. carbon monoxide          | _____ |
| 3. sulfur trioxide       | _____ | 8. diphosphorus trioxide    | _____ |
| 4. chlorine trifluoride  | _____ | 9. carbon dioxide           | _____ |
| 5. phosphorus tribromide | _____ | 10. dinitrogen pentoxide    | _____ |

II. Write the correct name for each of the following molecular (covalent) compounds. (**spelling matters**)

- |                                  |       |                                    |       |
|----------------------------------|-------|------------------------------------|-------|
| 1. N <sub>2</sub> O <sub>4</sub> | _____ | 6. B <sub>2</sub> O <sub>3</sub>   | _____ |
| 2. SiF <sub>4</sub>              | _____ | 7. BF <sub>3</sub>                 | _____ |
| 3. SiO <sub>2</sub>              | _____ | 8. N <sub>2</sub> O                | _____ |
| 4. IF <sub>7</sub>               | _____ | 9. As <sub>2</sub> O <sub>5</sub>  | _____ |
| 5. PCl <sub>3</sub>              | _____ | 10. P <sub>5</sub> O <sub>10</sub> | _____ |

III. Write the correct formula for each of the following binary compounds. Some are ionic, some are molecular.

*TIP: Ionic compounds contain a metal and/or a polyatomic ion. Covalent/molecular compounds are two nonmetals period.*

- |                                  |                              |
|----------------------------------|------------------------------|
| 1. dinitrogen tetroxide _____    | 5. sulfur hexafluoride _____ |
| 2. potassium oxide _____         | 6. cesium nitride _____      |
| 3. manganese (III) bromide _____ | 7. tin (IV) oxide _____      |
| 4. diphosphorus pentoxide _____  | 8. magnesium selenide _____  |

IV. Write the correct name for each of the following binary compounds. Some are ionic, some are molecular.

- |                                    |                         |
|------------------------------------|-------------------------|
| 1. $\text{CO}_2\text{O}_3$ _____   | 6. $\text{CaS}$ _____   |
| 2. $\text{P}_4\text{O}_{10}$ _____ | 7. $\text{AgI}$ _____   |
| 3. $\text{SnO}$ _____              | 8. $\text{SiH}_4$ _____ |
| 4. $\text{SbI}_5$ _____            | 9. $\text{SO}_2$ _____  |
| 5. $\text{P}_4\text{O}_6$ _____    | 10. $\text{CF}_4$ _____ |

### Part 5: Simple Hydrocarbons (Compounds with only carbon and hydrogen) (Read 2.9)

Data Table 3. Prefixes used for Simple Hydrocarbons.

Number of carbons	Prefix	Number of carbons	Prefix
1	meth-	6	hex-
2	eth-	7	hept-
3	prop-	8	oct-
4	but-	9	non-
5	pent-	10	dec-

Data Table 4. Suffixes used for Simple Hydrocarbons.

Chemical formula	Prefix	Example	Structure
$\text{C}_n\text{H}_{2n+2}$	-ane	propane	
$\text{C}_n\text{H}_{2n}$	-ene	propene	
$\text{C}_n\text{H}_{2n-2}$	-yne	propyne	
$\text{C}_n\text{H}_{2n+1}\text{OH}$	-anol	propanol	

I. Write the correct formula for each of the following hydrocarbons. (capitalization matters)

- |                  |                  |                    |
|------------------|------------------|--------------------|
| 1. hexane _____  | 5. butane _____  | 9. octane _____    |
| 2. hexene _____  | 6. butene _____  | 10. decyne _____   |
| 3. hexyne _____  | 7. butyne _____  | 11. nonene _____   |
| 4. hexanol _____ | 8. butanol _____ | 12. pentanol _____ |

## Part 6: Polyatomic Ions (Read 2.8)

Quizlet: Polyatomic Ion Practice: <https://quizlet.com/86537348/common-polyatomic-ions-flash-cards/>

Video: Tips on Memorizing Polyatomic Ions: <https://screencast-o-matic.com/watch/c3hlY0Vrojf>

I. Give the correct formula (subscripts and charges should be correct) for the following polyatomic ions.

- |                |       |                        |       |
|----------------|-------|------------------------|-------|
| 1. sulfate     | _____ | 9. hypoiodite          | _____ |
| 2. carbonate   | _____ | 10. hydroxide          | _____ |
| 3. phosphate   | _____ | 11. chromate           | _____ |
| 4. peroxide    | _____ | 12. oxalate            | _____ |
| 5. cyanide     | _____ | 13. hydrogen phosphate | _____ |
| 6. cyanate     | _____ | 14. bicarbonate        | _____ |
| 7. thiocyanate | _____ | 15. acetate            | _____ |
| 8. perbromate  | _____ | 16. thiosulfate        | _____ |

II. Give the correct name for the following polyatomic ions. (spelling counts, capitalization does not)

- |                                 |       |                                   |       |
|---------------------------------|-------|-----------------------------------|-------|
| 1. $\text{SO}_3^{2-}$           | _____ | 8. $\text{NH}_4^+$                | _____ |
| 2. $\text{Cr}_2\text{O}_7^{2-}$ | _____ | 9. $\text{Fe}(\text{CN})_6^{3-}$  | _____ |
| 3. $\text{PO}_3^{3-}$           | _____ | 10. $\text{Fe}(\text{CN})_6^{4-}$ | _____ |
| 4. $\text{H}_2\text{PO}_4^-$    | _____ | 11. $\text{NO}_3^-$               | _____ |
| 5. $\text{MnO}_4^-$             | _____ | 12. $\text{FO}_4^-$               | _____ |
| 6. $\text{AsO}_4^{3-}$          | _____ | 13. $\text{BrO}_3^-$              | _____ |
| 7. $\text{TeO}_3^{2-}$          | _____ | 14. $\text{IO}_2^-$               | _____ |

## Part 7: Ternary Compounds (Compounds with polyatomic ions) (Read 2.8)

Naming Compounds with Polyatomic Ions: <https://www.youtube.com/watch?v=p9iQ5Qn42DM>

Quizlet: Naming Compounds with Polyatomic Ions: <https://quizlet.com/147016697/binary-ternary-ionic-compounds-flash-cards/>

Quizlet: Naming Compounds with Polyatomic Ions and Transition Metals: <https://quizlet.com/147016972/naming-ionic-compounds-includes-roman-numerals-and-polyatomic-ions-flash-cards/>

I. Write the correct formula for the following ternary compounds (capitalization counts!)

- |                           |       |                            |       |
|---------------------------|-------|----------------------------|-------|
| 1. potassium nitrate      | _____ | 9. barium nitrite          | _____ |
| 2. copper (I) thiosulfate | _____ | 10. aluminum sulfate       | _____ |
| 3. calcium phosphate      | _____ | 11. cesium hydroxide       | _____ |
| 4. iron (II) acetate      | _____ | 12. manganese (IV) oxalate | _____ |
| 5. potassium permanganate | _____ | 13. iron (III) carbonate   | _____ |
| 6. magnesium chromate     | _____ | 14. sodium bromate         | _____ |
| 7. cobalt (II) chlorite   | _____ | 15. zinc hydroxide         | _____ |
| 8. tungsten (II) borate   | _____ | 16. ammonium periodate     | _____ |

- |                            |       |                                    |       |
|----------------------------|-------|------------------------------------|-------|
| 17. cesium dichromate      | _____ | 27. lithium dihydrogen phosphate   | _____ |
| 18. tin (IV) cyanide       | _____ | 28. ammonium iodate                | _____ |
| 19. strontium thiocyanate  | _____ | 29. tin (II) hydrogen sulfite      | _____ |
| 20. silver bromate         | _____ | 30. aluminum carbonate             | _____ |
| 21. sodium thiosulfate     | _____ | 31. sodium thiocyanate             | _____ |
| 22. mercury (I) sulfite    | _____ | 32. manganese (IV) sulfate         | _____ |
| 23. cadmium hydroxide      | _____ | 33. sodium perchlorate             | _____ |
| 24. lithium thiosulfate    | _____ | 34. mercury (II) phosphite         | _____ |
| 25. cobalt (III) phosphate | _____ | 35. cadmium hexacyanoferrate (III) | _____ |
| 26. lead (IV) bicarbonate  | _____ | 36. calcium acetate                | _____ |

II. Name the following ternary compounds: (spelling counts)

- |   |       |                                       |       |
|---|-------|---------------------------------------|-------|
| 1. $\text{NaNO}_3$                      | _____ | 16. $\text{Li}_3\text{BO}_3$          | _____ |
| 2. $\text{K}_3\text{PO}_4$              | _____ | 17. $\text{NH}_4\text{NO}_3$          | _____ |
| 3. $\text{NH}_4\text{NO}_2$             | _____ | 18. $\text{Ag}_3\text{PO}_4$          | _____ |
| 4. $\text{Sb}_3(\text{PO}_3)_5$         | _____ | 19. $\text{Cr}_2(\text{HPO}_4)_3$     | _____ |
| 5. $\text{K}_2\text{CO}_3$              | _____ | 20. $\text{KMnO}_4$                   | _____ |
| 6. $\text{BeSO}_4$                      | _____ | 21. $\text{Hg}(\text{BrO}_3)_2$       | _____ |
| 7. $\text{Li}_2\text{CrO}_4$            | _____ | 22. $\text{CsCN}$                     | _____ |
| 8. $\text{Ag}_2\text{CO}_3$             | _____ | 23. $\text{NH}_4\text{IO}_3$          | _____ |
| 9. $\text{Ba}(\text{ClO}_2)_2$          | _____ | 24. $\text{CoBO}_3$                   | _____ |
| 10. $\text{Pb}(\text{C}_2\text{O}_4)_2$ | _____ | 25. $\text{CoCr}_2\text{O}_7$         | _____ |
| 11. $\text{Cr}_2(\text{SO}_4)_3$        | _____ | 26. $\text{KFO}_4$                    | _____ |
| 12. $(\text{NH}_4)_3\text{PO}_3$        | _____ | 27. $\text{MnPO}_3$                   | _____ |
| 13. $\text{NaCN}$                       | _____ | 28. $\text{LiOH}$                     | _____ |
| 14. $\text{Sn}(\text{CO}_3)_2$          | _____ | 29. $\text{MgS}_2\text{O}_3$          | _____ |
| 15. $\text{CuSCN}$                      | _____ | 30. $\text{Hg}_2\text{S}_2\text{O}_3$ | _____ |

III. Give the correct name for the following MIXED compounds. (binary and ternary, ionic and covalent)

- |                                      |       |                                 |       |
|--------------------------------------|-------|---------------------------------|-------|
| 1. $\text{SO}_3$                     | _____ | 8. $(\text{NH}_4)_2\text{O}$    | _____ |
| 2. $\text{K}_2\text{Cr}_2\text{O}_7$ | _____ | 9. $\text{Bi}(\text{CN})_5$     | _____ |
| 3. $\text{Ag}_3\text{PO}_4$          | _____ | 10. $\text{BCl}_3$              | _____ |
| 4. $\text{SF}_6$                     | _____ | 11. $\text{Ra}(\text{OH})_2$    | _____ |
| 5. $\text{W}(\text{NO}_3)_3$         | _____ | 12. $\text{LiFO}_4$             | _____ |
| 6. $\text{MnCl}_4$                   | _____ | 13. $\text{Sb}(\text{BrO}_3)_3$ | _____ |
| 7. $\text{XeBr}_4$                   | _____ | 14. $\text{HgS}$                | _____ |

## Part 8: Acids (Read 2.8)

Video: Naming Acids: <https://www.youtube.com/watch?v=5Jb2u9ihfm4>

Quizlet: Naming Acids: <https://quizlet.com/147016388/naming-acids-flash-cards/>

### Data Table 5. Naming Acids

Anion Ending	Acid Name	Example
-ide	hydro-( <i>stem</i> )-ic acid	HCl hydrochloric acid
-ite	( <i>stem</i> )-ous acid	HNO <sub>2</sub> nitrous acid
-ate	( <i>stem</i> )-ic acid	H <sub>2</sub> SO <sub>4</sub> sulfuric acid

I. Write the correct formula for the following acids:

- |                        |       |                      |       |
|------------------------|-------|----------------------|-------|
| 1. perchloric acid     | _____ | 11. iodic acid       | _____ |
| 2. chloric acid        | _____ | 12. permanganic acid | _____ |
| 3. chlorous acid       | _____ | 13. bromic acid      | _____ |
| 4. hypochlorous acid   | _____ | 14. fluoric acid     | _____ |
| 5. sulfurous acid      | _____ | 15. selenic acid     | _____ |
| 6. carbonic acid       | _____ | 16. hydroiodic acid  | _____ |
| 7. oxalic acid         | _____ | 17. chromic acid     | _____ |
| 8. hydrosulfuric acid  | _____ | 18. nitrous acid     | _____ |
| 9. nitric acid         | _____ | 19. iodous acid      | _____ |
| 10. hydrotelluric acid | _____ | 20. cyanic acid      | _____ |

II. Name the following acids:

- |                                    |       |   |       |
|------------------------------------|-------|---|-------|
| 1. HBrO <sub>4</sub>               | _____ | 13. HNO <sub>2</sub>                              | _____ |
| 2. HBrO <sub>3</sub>               | _____ | 14. HNO <sub>3</sub>                              | _____ |
| 3. HBrO <sub>2</sub>               | _____ | 15. H <sub>3</sub> BO <sub>3</sub>                | _____ |
| 4. HBrO                            | _____ | 16. H <sub>2</sub> S                              | _____ |
| 5. HBr                             | _____ | 17. H <sub>3</sub> PO <sub>3</sub>                | _____ |
| 6. HF                              | _____ | 18. H <sub>2</sub> SeO <sub>3</sub>               | _____ |
| 7. HFO                             | _____ | 19. H <sub>3</sub> PO <sub>4</sub>                | _____ |
| 8. HFO <sub>2</sub>                | _____ | 20. HCN   | _____ |
| 9. HFO <sub>3</sub>                | _____ | 21. H <sub>2</sub> SO <sub>4</sub>                | _____ |
| 10. HFO <sub>4</sub>               | _____ | 22. HC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> | _____ |
| 11. H <sub>2</sub> CO <sub>3</sub> | _____ | 23. H <sub>2</sub> CrO <sub>4</sub>               | _____ |
| 12. HMnO <sub>4</sub>              | _____ | 24. H <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> | _____ |

Quizlet: Naming All Types of Compounds Mixed Together: <https://quizlet.com/147015356/naming-compounds-chemical-formulas-all-types-flash-cards/>

## Part 9: Dimensional Analysis using metric conversions (Read 1.4, 1.6)

**You must show all work using conversion units as shown below.**

Dimensional Analysis with the Metric System: <https://www.youtube.com/watch?v=5EcNAxweb44>

*Example:* The recommended daily allowance (RDA) for folic acid is 400  $\mu\text{g}$ . How many grams is this equivalent to? kg?

$$400 \mu\text{g} \times \frac{1 \text{ g}}{10^6 \text{ ug}} = 4 \times 10^{-4} \text{ g} \quad 400 \mu\text{g} \times \frac{1 \text{ g}}{10^6 \text{ ug}} \times \frac{1 \text{ kg}}{10^3 \text{ g}} = 4 \times 10^{-7} \text{ kg}$$

1. The element xenon (what is its symbol?) has an atomic radius of 216 pm. How many meters is this?
2. A proton weighs  $1.6726 \times 10^{-24}$  g. How much does the proton weigh in picograms?
3. An electron weighs 1,837 times lighter than a proton. An electron weighs  $9.11 \times 10^{-31}$  kg. How much does an electron weigh in nanograms?
4. The triple bond between two nitrogen atoms in a nitrogen molecule is one of the strongest bonds known. It requires 941 kJ of energy to break one mole of these bonds. How much energy, in Joules (J), is this?
5. The triple bond in a nitrogen molecule is also a rather short bond at only 110 pm. How long is this bond in centimeters? Micrometers?
6. Chemists have determined that 18.0 g of water consists of  $6.022 \times 10^{23}$  molecules. Assuming that a teaspoon holds 3.70 mL of water, determine the number of water molecules the teaspoon can hold. (1mL  $\text{H}_2\text{O}$  = 1 g  $\text{H}_2\text{O}$ )
7. The RDA (recommended daily allowance) of iron is about 14 milligrams. The average 2-inch nail weighs about 2.51 grams. If you got your RDA of iron each day by eating iron fortified cereal, how many nails worth of iron would you eat in one year?
8. The density of iron is  $7.86 \text{ g/cm}^3$ . What volume would an average 2 – inch nail, weighing 2.51 g occupy?

## Part 10: Rearranging Equations

Write the new rearranged equation for variable given in the given equation.

Example: Solve for  $P_2$  using  $P_1V_1 = P_2V_2$       Answer:  $P_2 = P_1V_1 / V_2$

1. Solve for C using  $q = mc\Delta t$

9. Solve for m using  $K.E. = \frac{1}{2}mv^2$

2. Solve for m using  $q = mc\Delta t$

10. Solve for v using  $K.E. = \frac{1}{2}mv^2$

3. Solve for  $P_2$  using  $P_1V_1 = P_2V_2$

11. Solve for Rate<sub>1</sub> using  $\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}}$

4. Solve for  $V_1$  using  $P_1V_1 = P_2V_2$

12. Solve for  $M_2$  using  $\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}}$

5. Solve for  $V_2$  using  $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

13. Solve for b using  $a = -\log b$  (assume base 10!)

6. Solve for  $T_1$  using  $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

14. Solve for a using  $10^{-a} = b$

7. Solve for  $T_2$  using  $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

15. Solve for k using  $\ln [A] = -kt + \ln [A]_0$

8. Solve for  $P_a$  using  $P_{\text{tot}} = P_a + P_b + P_c$

16. Solve for K using  $G = -RT \ln K$

# Periodic Table of the Elements

1 <b>H</b> 1.01																	2 <b>He</b> 4.00	
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01											5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00	10 <b>Ne</b> 20.18	
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.30											13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.06	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95	
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.90	23 <b>V</b> 50.94	24 <b>Cr</b> 52.00	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.70	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.61	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80	
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> (97.91)	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.30	
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57-70 *	71 <b>Lu</b> 174.97	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.84	75 <b>Re</b> 186.21	76 <b>Os</b> 190.23	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.08	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.19	83 <b>Bi</b> 208.98	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> 226.03	89-102 **	103 <b>Lr</b> (262.11)	104 <b>Rf</b> (261.11)	105 <b>Db</b> (262.11)	106 <b>Sg</b> (263.12)	107 <b>Bh</b> (270)	108 <b>Hs</b> (277.15)	109 <b>Mt</b> (276.15)	110 <b>Ds</b> (281.16)	111 <b>Rg</b> (280.16)	112 <b>Cn</b> (285.17)	113 <b>Nh</b> (284.18)	114 <b>Fl</b> (289.19)	115 <b>Mc</b> (288.19)	116 <b>Lv</b> (293)	117 <b>Ts</b> (294)	118 <b>Og</b> (294)

*	57 <b>La</b> 138.91	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.4	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.92	66 <b>Dy</b> 162.50	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.04
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**	89 <b>Ac</b> (227.03)	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> (237.05)	94 <b>Pu</b> (244.06)	95 <b>Am</b> (243.06)	96 <b>Cm</b> (247.07)	97 <b>Bk</b> (247.07)	98 <b>Cf</b> (251.08)	99 <b>Es</b> (252.08)	100 <b>Fm</b> (257.10)	101 <b>Md</b> (258.10)	102 <b>No</b> (259.10)
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## 52 SYMBOLS OF COMMON ELEMENTS – memorize all

Ag	silver	Kr	krypton
Al	aluminum	Li	lithium
Ar	argon	Mg	magnesium
As	arsenic	Mn	manganese
Au	gold	N	nitrogen
B	boron	Na	sodium
Ba	barium	Ne	neon
Be	beryllium	Ni	nickel
Bi	bismuth	O	oxygen
Br	bromine	P	phosphorus
C	carbon	Pb	lead
Ca	calcium	Pt	platinum
Cd	cadmium	Pu	plutonium
Cl	chlorine	Ra	radium
Co	cobalt	Rn	radon
Cr	chromium	S	sulfur
Cs	cesium	Sb	antimony
Cu	copper	Se	selenium
F	fluorine	Si	silicon
Fe	iron	Sn	tin
Ga	gallium	Sr	strontium
H	hydrogen	Te	tellurium
He	helium	U	uranium
Hg	mercury	W	tungsten
I	iodine	Xe	xenon
K	potassium	Zn	zinc

# Common Polyatomic Ions – memorize the bolded ones only, be able to use others

<b>-1 Charge</b>		<b>-2 Charge</b>	
Formula	Name	Formula	Name
$\text{H}_2\text{PO}_4^-$	dihydrogen phosphate	$\text{HPO}_4^{2-}$	hydrogen phosphate
$\text{C}_2\text{H}_3\text{O}_2^-$	acetate*	$\text{C}_2\text{O}_4^{2-}$	oxalate
$\text{HSO}_3^-$	hydrogen sulfite (bisulfite)	$\text{SO}_3^{2-}$	sulfite
$\text{HSO}_4^-$	hydrogen sulfate (bisulfate)	$\text{SO}_4^{2-}$	sulfate
$\text{HCO}_3^-$	hydrogen carbonate (bicarbonate)	$\text{CO}_3^{2-}$	carbonate
$\text{NO}_2^-$	nitrite	$\text{S}_2\text{O}_3^{2-}$	thiosulfate
$\text{NO}_3^-$	nitrate	$\text{CrO}_4^{2-}$	chromate
$\text{CN}^-$	cyanide	$\text{Cr}_2\text{O}_7^{2-}$	dichromate
$\text{CNO}^-$	cyanate	$\text{O}_2^{2-}$	peroxide
$\text{SCN}^-$	thiocyanate	$\text{SeO}_4^{2-}$	selenate
$\text{OH}^-$	hydroxide	$\text{SeO}_3^{2-}$	selenite
$\text{MnO}_4^-$	permanganate	$\text{TeO}_3^{2-}$	tellurite
$\text{ClO}^-$	hypochlorite	$\text{TeO}_4^{2-}$	tellurate
$\text{ClO}_2^-$	chlorite		
$\text{ClO}_3^-$	chlorate		
$\text{ClO}_4^-$	perchlorate		
$\text{BiO}_3^-$	bismuthate		

\* $\text{CH}_3\text{COO}^-$  may also be used for acetate

<b>-3 Charge</b>		<b>+1/+2 Charge</b>	
Formula	Name	Formula	Name
$\text{PO}_3^{3-}$	phosphite	$\text{NH}_4^+$	ammonium
$\text{PO}_4^{3-}$	phosphate	$\text{Hg}_2^{+2}$	mercury (I)
$\text{BO}_3^{3-}$	borate		<b>-4 Charge</b>
$\text{AsO}_3^{3-}$	arsenite	$\text{Fe}(\text{CN})_6^{4-}$	hexacyanoferrate (II)
$\text{AsO}_4^{3-}$	arsenate		
$\text{Fe}(\text{CN})_6^{3-}$	hexacyanoferrate (III)		

## Tips for helping you to learn the polyatomic ions:

A polyatomic ion is a group of atoms that, as a whole, act as an ion (have a charge).

The trick is that lots of the ions have oxygens attached, and the number seems to vary a lot.

**So you have to learn how many oxygens are attached AS WELL AS the charge on the ion as a whole.**

### • So how do you keep up with the charge?

This is easy! For *many* of the polyatomic ions containing oxygen, the charge is exactly the same as that on the monatomic ion.

**Examples:** sulfate and sulfite ions both have a -2 charge, as does the sulfide ion!

phosphate and phosphite both have a -3 charge, as does the phosphide ion!

hypochlorite, chlorite, chlorate, and perchlorate ions all have a -1 charge, as does the chloride ion!

**Exceptions:** nitrate, nitrite, bismuthate, carbonate, and borate

Notice that boron, carbon, and nitrogen are in a row:

5	6	7
<b>B</b>	<b>C</b>	<b>N</b>
10.81	12.01	14.01

And borate, carbonate, and nitrate have charges of

-3      -2      -1

### • So how do you remember how many oxygens to add?

Divide up your periodic table into outer nonmetals and inner nonmetals like so:

(These are artificial designations, but they help!)

5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00
		15 <b>P</b> 30.97	16 <b>S</b> 32.06	17 <b>Cl</b> 35.45
		33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90
			52 <b>Te</b> 127.60	53 <b>I</b> 126.90
		83 <b>Bi</b> 208.98		

We'll call B, C, N, O, F, Cl, Br, and I the "outer" nonmetals. All the rest will be "inner" nonmetals.

(This is an artificial designation, but useful for memorizing polyatomic ions)

The outer nonmetals (unshaded)

combine with 4 oxygens to make "per\_\_\_\_\_ate" ions

Examples: perchlorate is  $\text{ClO}_4^-$ , perbromate is  $\text{BrO}_4^-$ , periodate is  $\text{IO}_4^-$

combine with 3 oxygens to make "\_\_\_\_\_ate" ions

Examples: iodate is  $\text{IO}_3^-$ , nitrate is  $\text{NO}_3^-$ , sulfate is  $\text{SO}_4^{2-}$

combine with 2 oxygens to make "\_\_\_\_\_ite" ions

Examples: fluorite is  $\text{FO}_2^-$ , nitrite is  $\text{NO}_2^-$

combine with 1 oxygen to make "hypo\_\_\_\_\_ite" ions

Examples: hypofluorite is  $\text{FO}^-$ , hypochlorite is  $\text{ClO}^-$ , hypobromite is  $\text{BrO}^-$

The inner nonmetals (shaded)

combine with 4 oxygens to make "\_\_\_\_\_ate" ions

Examples: phosphate is  $\text{PO}_4^{3-}$ , arsenate is  $\text{AsO}_4^{3-}$ , permanganate is  $\text{MnO}_4^-$

combine with 3 oxygens to make "\_\_\_\_\_ite" ions

Examples: phosphite is  $\text{PO}_3^{3-}$ , arsenite is  $\text{AsO}_3^{3-}$ , sulfite is  $\text{SO}_3^{2-}$

**\*\*Exception to inner-outer rules: bismuthate only has three oxygens**