

## AP Chemistry Summer Assignment

Dear Chemistry Parents/Guardians and Students:

Welcome to AP Chemistry! I am excited that your student has decided to take on the challenge of such a course and look forward to having him/her in my class. This course is designed to be the equivalent of a first-year general chemistry *college* course. As a result, this is only for high school students who are skilled and/or interested in chemistry, and are willing to demonstrate very high levels of commitment, motivation, and academic maturity.

In order to prepare students for the rigors of the course, each will be expected to complete a Summer Assignment. Since students entering AP Chemistry have had a variety of Chemistry 1 experiences, completion of the summer assignment will help all students begin the year on equal footing as the assignment will help them review Chemistry 1 topics. A completed summer assignment is a key to success in this class. I have broken the Summer Assignment into five sections. It is required for the students to complete one section every two weeks and then submit that section in a box which will be located in the guidance office. The table below lists the due dates of each section.

Assignment Number	Due Date
1	July 10th
2	July 24 <sup>th</sup>
3	August 7 <sup>th</sup>
4	August 21 <sup>st</sup>
5	September 4 <sup>th</sup>

Each section is worth 50 points; the total value of the Summer Assignment is 250 points. These due dates are not absolutes, as that I understand vacations and trips have already been planned; they are to ensure that work is done throughout the summer. If you will be out of town for one or more of the due dates, then you *must* get in touch with me and make an alternate arrangement. It is imperative that this Summer Assignment is spread throughout the summer and not completed the week prior to school starting.

Enrollment in this course is a commitment to perform at the highest level and to display a positive attitude within the class. Seriousness in maximizing one's problem solving skills is expected. Due to the advanced level of the course, considerable time will be spent on mathematical calculations, both in lab and in class. Students will be expected to devote time in study of new material and in completion of practice problems, as well as developing quality laboratory skills and reporting practices. The College Board makes the following statement in the course description in relation to student commitment: **"It is assumed that the student will spend at least five hours a week in unsupervised individual study."** AP Chemistry is hard, and cannot be mastered by memorization alone; chemistry is a thinking discipline and students must demonstrate the maturity and self-discipline to approach it as such.

The goal of this course is to prepare each student for the Advanced Placement Chemistry Exam as well as enrollment in a second year chemistry course in college. Students who enroll in this course without an honors Chemistry background or who

## AP Chemistry Summer Assignment

have received less than a 90% average in Chemistry 1 may not be prepared to deal with the volume of work, mathematical computations, and performance level required for above average grades in an accelerated program. Students should plan on anywhere from 30-90 minutes of homework per class, and are expected to demonstrate a proactive approach to their work. Parents/guardians and students must understand that these requirements and time limits are not negotiable simply because this is what is required for success in this course. If you have concerns, please feel free to call or email me at the information listed below.

Sincerely,

Stephen Fox  
Stephen.fox@fcps.edu  
(703)887-7893

### **AP CHEMISTRY SUMMER ASSIGNMENT**

#### **Section One**

1. Round the following numbers to three significant figures.

4325

$6.873 \times 10^3$

0.17354

2. Perform the indicated operations and round your answers to the proper number of significant figures. Assume that all answers were obtained from measurements.

$(2.11 \times 10^{-3}) + (1.54 \times 10^{-3})$

$(1.54 \times 10^{-3}) + (2.11 \times 10^{-2})$

$(4.56 + 18.7)/(1.23 \times 10^2)$

$(1.23 \times 10^{-2})(4.56 + 1.87)$

3. Make the following conversions:

0.75 kg to milligrams

1500 millimeters to km

2390 g to kg

## AP Chemistry Summer Assignment

0.52 km to meters

4. How many cubic meters ( $\text{m}^3$ ) are there in 4312 cubic centimeters ( $\text{cm}^3$ )?

5. The helium gas stored inside a large weather balloon weighs 13.558 grams. What is the volume of this balloon if the density of helium is 0.1786 g/L?

6. A rectangular block of copper metal weighs 1896 grams. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper?

7. Write the formula for the following compounds:

ammonium sulfide

sodium nitrate

aluminum sulfate

potassium nitrate

lead (II) phosphate

diphosphorus pentoxide

calcium fluoride

8. Write the name of the following compounds:

KF

$\text{CaSO}_4$

HCl

$\text{SbCl}_3$

$\text{As}_4\text{O}_{10}$

$\text{NH}_4\text{Cl}$

$\text{NH}_4\text{NO}_3$

$\text{IF}_5$

$\text{NaHCO}_3$

$\text{Ba(OH)}_2$

9. Write the electron configuration (long way) for sulfur.

10. Write the orbital notation (boxes) for magnesium.

## AP Chemistry Summer Assignment

11. Write the electron configuration using the Noble Gas shortcut for radium.

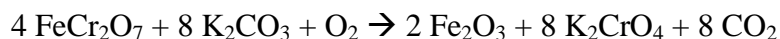
12. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

Sodium hydroxide (aq) + sulfuric acid (aq)  $\rightarrow$  sodium sulfate (aq) + water (l)

Magnesium (s) + oxygen (g)  $\rightarrow$  magnesium oxide (s)

13. Calculate the percentage composition of the following compounds:  
Ferric oxide

Silver (I) oxide



14. How many grams of iron (II) dichromate are required to produce 44.0 grams of carbon dioxide?

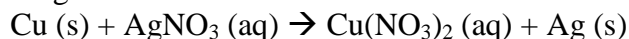
15. How many grams of oxygen gas are required to produce 100.0 grams of ferric oxide?

16. If 300.0 grams of iron (II) dichromate react, how many grams of oxygen gas will be consumed?

## AP Chemistry Summer Assignment

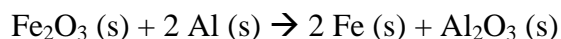
17. How many grams of iron (III) oxide will be produced from 300.0 grams of ferrous dichromate?

18. If 5.00 grams of copper metal react with a solution containing 20.0 grams of  $\text{AgNO}_3$ , which reactant is limiting?



19. What is the volume of a sample of oxygen gas that has a mass of 50.0 grams and is under a pressure of 1.20 atm at 27.0°C?

20. The thermite reaction has been used to weld railroad tracks. The reaction is



How many grams of aluminum would be needed to produce 15.0 grams of iron?

21. Sea water contains roughly 28.0 grams of NaCl per liter. What is the molarity of sodium chloride in sea water?

22. What is the molarity of 245.0 grams of  $\text{H}_2\text{SO}_4$  dissolved in 1.00 L of solution?

23. What is the molarity of 5.30 grams of  $\text{Na}_2\text{CO}_3$  dissolved in 400.0 mL solution?

24. Calculate the empirical formula of the compounds which have the following percentage compositions:

## AP Chemistry Summer Assignment

40.2 % K, 26.9% Cr, and 32.9% O

21.8 % Mg, 27.9% P, and 50.3% O

25. In what order are the elements listed on the PRESENT periodic table?  
State the periodic law.

What name is given to the elements in a vertical column on the periodic table?

What name is given to the elements in a horizontal row on the periodic table?

### Section Two

1. How many significant figures does each of the numbers contain?

0.0278 meter

1.3 centimeter

1.00 foot

2. Make the following conversions:

65 kg to grams

750 micrograms to grams

0.25 nanometers to cm

3. How many cubic decimeters ( $\text{dm}^3$ ) are there in  $1.773 \times 10^5$  cubic meters ( $\text{m}^3$ )?

## AP Chemistry Summer Assignment

4. What volume of silver metal will weigh exactly 2500.0 grams? The density of silver is  $10.5 \text{ g/cm}^3$ .

5. What is the weight of 215 L of hydrogen sulfide gas if the density of hydrogen sulfide is  $1.54 \text{ g/L}$ ?

6. Write the electron configuration (long way) for palladium.

7. Write the orbital notation (boxes) for scandium.

8. Write the formula for the following compounds:

sodium chromate

potassium phosphate

nickel (II) iodide

lead (II) chloride

9. Write the name of the following compounds:

$\text{FeCl}_3$

$\text{HF}$

$\text{PbSO}_4$

$\text{KrF}_2$

$\text{NaCl}$

10. Write the electron configuration using the Noble Gas shortcut for californium.

11. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

Calcium hydroxide (aq) + nitric acid (aq)  $\rightarrow$

Zinc chloride (aq) + ammonium sulfide (aq)  $\rightarrow$

12. Determine the percentage of sodium in sodium sulfate.

## AP Chemistry Summer Assignment

Given the reaction  $S + O_2 \rightarrow SO_2$

13. How many grams of sulfur must be burned to give 100.0 grams of  $SO_2$ ?
  
14. How many grams of oxygen will be required for the reaction in number 13?
  
15. What is the volume at STP of a sample of  $CO_2$  that has a volume of 75.0mL at  $30.0^\circ C$  and 680 mm Hg?
  
16. What is the volume of a sample of oxygen gas that has a mass of 50.0 grams and is under a pressure of 1.2 atm at  $27.0^\circ C$ ?
  
17. The thermite reaction has been used to weld railroad tracks. The reaction is
$$Fe_2O_3 (s) + 2 Al (s) \rightarrow 2 Fe (s) + Al_2O_3 (s)$$
How many grams of iron (III) oxide would be needed to produce 25.0 grams of iron?
  
18. What is the molarity of 5.00 grams of NaOH in 750.0 mL of solution?
  
19. How many moles of  $Na_2CO_3$  are in 10.0 mL of a 2.0 M solution?
  
20. How many moles of  $Na_2CO_3$  are in 10.0 mL of a 0.20 M solution?
  
21. How many moles of NaCl are contained in 100.0 mL of a 0.20 M solution?

## AP Chemistry Summer Assignment

22. What is the most active metal?

23. What is the most active nonmetal?

24. Calculate the empirical formula of the compounds which have the following percentage compositions:

65.7% Sr, 10.4% Si, and 23.9% O

34.58% Na, 23.30% P, and 42.12% O

25. What is the significance of the zig zag line running diagonally down and to the right near the right side of the periodic table?

26. What element has the lowest ionization energy?

### Section Three

1. Express the following numbers with the indicated number of significant figures.

1000 (2 sig figs)

43,927 (3 sig figs)

0.000286 (3 sig figs)

2. Make the following conversions:

2.77 kg to mg

2.90 cm to megameters

45.6 microliters to kiloliters

3. 28.5 grams of iron shot is added to a graduated cylinder containing 45.5 mL of water. The water level rises to the 49.1 mL mark. From this information, calculate the density of iron.

## AP Chemistry Summer Assignment

4. A cylindrical glass tube of length 27.75 cm and the radius 2.00 cm is filled with argon gas. The empty tube weighs 188.25 grams and the tube filled with argon weighs 188.87 grams. Use the data to calculate the density of argon gas. (Volume of a cylinder =  $\pi r^2 h$ .)

5. Write the formula for the following compounds:

Sodium phosphate

Silver hypochlorite

Ammonium phosphate

Potassium sulfide

Tin (IV) bromide

Lithium chromate

Sulfurous acid

Potassium hydroxide

6. Write the names of the following compounds:

$\text{FePO}_4$

$\text{Hg}_2\text{SO}_4$

KH

7. Write the electron configuration (long way) for yttrium.

8. Write the orbital notation (boxes) for zinc.

9. Write the electron configuration using the Noble Gas shortcut for mendelevium.

10. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:

Sulfuric acid (aq) + potassium hydroxide (aq)  $\rightarrow$

Zinc (s) + sulfuric acid (aq)  $\rightarrow$

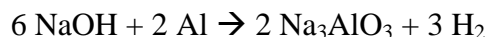
11. For the compound sodium sulfate decahydrate,  $\text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$ , calculate the following:

% Na

AP Chemistry Summer Assignment

%O

%H<sub>2</sub>O



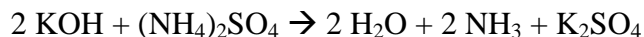
12. How much aluminum is required to produce 17.5 grams of hydrogen?

13. How much Na<sub>3</sub>AlO<sub>3</sub> can be formed from 165.0 grams of sodium hydroxide?

14. How many moles of NaOH are required to produce 3.0 grams of hydrogen?

15. How many mol of hydrogen can be prepared from 1.0 grams of aluminum?

16. If 20.0 grams of KOH react with 15.0 grams of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, calculate the moles of K<sub>2</sub>SO<sub>4</sub> produced.



17. A rigid container holds a gas at a pressure of 0.55 atm at -100°C. What will the pressure be when the temperature is increased to 200°C?

18. What weight (in grams) of NaCl would be contained in 100.0 mL of a 0.20 M NaCl solution?

19. What weight in grams of H<sub>2</sub>SO<sub>4</sub> would be needed to make 750.0 mL of a 2.00 M solution?

## AP Chemistry Summer Assignment

20. What volume in mL of 18.0 M  $\text{H}_2\text{SO}_4$  is needed to contain 2.45 grams of  $\text{H}_2\text{SO}_4$ ?

21. Calculate the empirical formulas for the following:

Fe 77.7% and O 22.3 %

Fe 72.4 % and O 27.6 %

22. What element has the highest ionization energy?

23. Metals \_\_\_\_\_ electrons. (Gain or lose)

24. Nonmetals \_\_\_\_\_ electrons. (Gain or lose)

### Section Four

1. Express the following exponentials as ordinary numbers:

$7.23 \times 10^4$

$8.193 \times 10^2$

$1.98 \times 10^{-3}$

2. Make the following conversions:

$9.57 \times 10^{-8}$  mm to nm

2.00 L to mL

35.38 mL to L

5000  $\text{cm}^3$  to mL

3. The volume of a sample of water is found to be 86.3  $\text{cm}^3$ . What is the volume of the sample in  $\text{mm}^3$ ?

4. Find the weight of 250.0 mL of benzene. The density of benzene is 0.90 g/mL.

## AP Chemistry Summer Assignment

5. A block of lead has dimensions of 4.5 cm by 5.2 cm by 6.0 cm. The block weighs 1587 g. From this information, calculate the density of lead.

6. Write the formula for the following compounds:

ferric oxide

silver phosphate

barium carbonate

calcium iodide

zinc phosphate

7. Write the name of the following compounds:

$\text{Sr}(\text{HCO}_3)_2$

$\text{Sr}(\text{OH})_2$

$\text{P}_4\text{S}_{10}$

$\text{Hg}_2\text{O}_2$

8. Write the electron configuration (long way) for barium.

9. Write the orbital notation (boxes) for selenium.

10. Write the electron configuration using the Noble Gas shortcut for protactinium.

11. Write a balanced equation and indicate the reaction type (single or double replacement, decomposition, or composition/synthesis) for each of the following:  
chlorine (g) + magnesium iodide (Aq)  $\rightarrow$

iron (s) + hydrochloric acid (aq)  $\rightarrow$

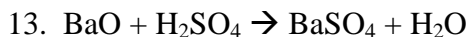
12. Calculate the percentage of nitrogen in each of the following compounds:

$\text{NH}_4\text{NO}_3$

$(\text{NH}_4)_2\text{SO}_3$

AP Chemistry Summer Assignment

HNO2

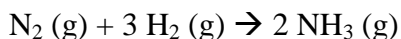


How much barium sulfate can be formed from 196.0 grams of sulfuric acid?

14. If 81.00 g of  $\text{H}_2\text{O}$  is formed during this reaction, how much  $\text{BaO}$  was used?

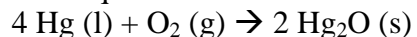
15. A volume of 20.0 L of  $\text{O}_2$  is warmed from  $-30.0^\circ\text{C}$  to  $85.0^\circ\text{C}$ . What is the new volume, if the pressure is kept constant?

16. Ammonia is produced by the reaction of nitrogen and hydrogen according to this balanced equation:



What mass of ammonia would be produced if 13.4 grams of nitrogen gas reacted?

17. Given the following balanced equation



What volume of oxygen gas will be required to produce the 23.7 grams of mercury (I) oxide at STP?

18. What volume (in mL) of 18.0 M  $\text{H}_2\text{SO}_4$  is needed to contain 2.45 grams of  $\text{H}_2\text{SO}_4$ ?

19. How many grams of  $\text{Ca}(\text{OH})_2$  are needed to make 100.0 mL of a 0.250 M solution?

20. What is the molarity of a solution made by dissolving 20.0 grams of  $\text{H}_3\text{PO}_4$  in 50.0 mL of solution?

## AP Chemistry Summer Assignment

21. How many electrons are in the valence shell of:  
the Halogens?  
the Oxygen family?  
the alkali metals?  
the boron family?  
the inert gases?  
the alkaline earth metals?  
the carbon family?  
the nitrogen family?
22. Each period on the periodic table represents a(n) \_\_\_\_\_ in the atom.
23. What is meant by nuclear shielding?
24. Why do atomic radii decrease from left to right within a period?

### Section Five

1. Perform the indicated operations and round off your answers to the proper number of significant figures. Assume that all numbers were obtained from measurements.

$$18.56 + 1.233$$

$$1.234 \times 0.247$$

$$4.3/8.87$$

2. Make the following conversions:

105 m to km

$2.0043 \times 10^{-5}$  km to m

1.549  $\mu\text{m}$  to km

3. How many  $\text{km}^3$  are there in  $4.261 \times 10^4 \text{ m}^3$ ?

4. A rubber balloon weighing 144.85 grams is filled with carbon dioxide gas and reweighed. The weight of the balloon plus gas is 153.77 grams. The volume of the balloon filled with carbon dioxide is 4.55 L. What is the density of carbon dioxide?

## AP Chemistry Summer Assignment

5. Calculate the density of sulfuric acid if 35.4 mL of the acid weighs 65.14 grams.

6. Write the formulas for the following compounds:

sodium nitrite

silver oxide

nickel (II) bromide

magnesium oxide

oxygen difluoride

acetic acid

ammonium hydroxide

cobalt (II) iodide

chromium (II) bicarbonate

sodium hydroxide

silver nitrate

mercury (II) nitrate

7. Write the name of the following compounds:

$N_2O_5$

$SnCrO_4$

$Al_2O_3$

$CuCO_3$

$ClO_2$

$CuS$

$MgI_2$

$CoCl_3$

$NaCN$

$Hg_3N_2$

8. Write the electron configuration (long way) for francium.

9. Write the orbital notation (boxes) for cadmium.

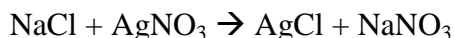
10. Write the electron configuration using the Noble Gas shortcut for lead.

11. Calculate the mass of the metal in each of the following compounds:

20.0 grams of chromium (II) chloride

AP Chemistry Summer Assignment

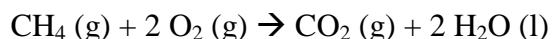
10.0 grams of copper (II) bromide



12. If you have 78.00 grams of NaCl, how many grams of AgCl should be produced?

13. How much AgCl can be produced from 107.0 grams of AgNO<sub>3</sub>?

14. If 20.0 L of methane, CH<sub>4</sub>, react with 200.0 L of oxygen, calculate the L of carbon dioxide gas produced.



15. A mass of air occupies a volume of 5.7 L at a pressure of 0.52 atm. What is the new pressure if the same mass of air at the same temperature is transferred to a 2.0 L container?

16. What weight in grams of KCl is there in 2.50 L of a 0.50 M KCl solution?

17. What is the molarity of a solution containing 12.0 grams of NaOH in 250.0 mL of solution?

18. One compound of chromium contains 57.9% chlorine and a second compound contains 67.3% chlorine. What are the empirical formulas of these two chromium chloride compounds?

19. Arrange each of the following in order of increasing atomic radii:

## AP Chemistry Summer Assignment

the alkaline earth metals

the noble gases

the main group elements in the third period

C, Si, Sn, Pb

20. Arrange the following in order of decreasing radius: Br, I, Se, Li.

21. Why does ionization energy increase from left to right across a period?

22. Arrange the members of each of the following sets of elements in order of increasing first ionization energy:

the alkali metals

the halogens

# AP Chemistry Summer Assignment

## Appendix A: Common Polyatomic Ions

carbon	nitrogen	sulfur	chlorine
$\text{CO}_3^{2-}$ carbonate	$\text{NO}_3^-$ <a href="#">nitrate</a> $\text{NO}_2^-$ nitrite	$\text{SO}_4^{2-}$ sulfate $\text{SO}_3^{2-}$ sulfite  $\text{S}_2\text{O}_3^{2-}$ <a href="#">thiosulfate</a> $\text{HSO}_4^-$ hydrogen sulfate ( <i>bisulfate</i> ) $\text{HSO}_3^-$ hydrogen sulfite ( <i>bisulfite</i> )	$\text{ClO}_4^-$ perchlorate $\text{ClO}_3^-$ chlorate $\text{ClO}_2^-$ chlorite $\text{ClO}^-$ hypochlorite
$\text{HCO}_3^-$ hydrogen carbonate ( <i>bicarbonate</i> )			
phosphorus	cyanide	cations	metal oxyanions
$\text{PO}_4^{3-}$ phosphate $\text{HPO}_4^{2-}$ hydrogen phosphate $\text{H}_2\text{PO}_4^-$ dihydrogen phosphate	$\text{CN}^-$ <a href="#">cyanide</a> $\text{OCN}^-$ cyanate $\text{SCN}^-$ thiocyanate	$\text{NH}_4^+$ ammonium $\text{H}_3\text{O}^+$ hydronium $\text{Hg}_2^{2+}$ <a href="#">mercury(I)</a>	$\text{CrO}_4^{2-}$ chromate $\text{Cr}_2\text{O}_7^{2-}$ dichromate $\text{MnO}_4^-$ permanganate
oxygen	organics		
$\text{OH}^-$ hydroxide $\text{O}_2^{2-}$ peroxide	$\text{C}_2\text{H}_3\text{O}_2^-$ acetate		

Table of common polyatomic cations, arranged by charge.

+2	-1	-2
$\text{Hg}_2^{2+}$ <a href="#">mercury(I)</a> or <i>mercurous</i>	$\text{C}_2\text{H}_3\text{O}_2^-$ acetate $\text{ClO}_3^-$ chlorate $\text{ClO}_2^-$ chlorite	$\text{CO}_3^{2-}$ carbonate $\text{CrO}_4^{2-}$ chromate $\text{Cr}_2\text{O}_7^{2-}$ dichromate
+1	$\text{CN}^-$ <a href="#">cyanide</a> $\text{H}_2\text{PO}_4^-$ dihydrogen phosphate $\text{HCO}_3^-$ hydrogen carbonate or <i>bicarbonate</i> $\text{HSO}_4^-$ hydrogen sulfate or <i>bisulfate</i> $\text{OH}^-$ hydroxide $\text{ClO}^-$ hypochlorite $\text{NO}_3^-$ <a href="#">nitrate</a> $\text{NO}_2^-$ nitrite $\text{ClO}_4^-$ perchlorate $\text{MnO}_4^-$ permanganate $\text{SCN}^-$ thiocyanate	$\text{HPO}_4^{2-}$ hydrogen phosphate $\text{O}_2^{2-}$ peroxide $\text{SO}_4^{2-}$ sulfate $\text{SO}_3^{2-}$ sulfite $\text{S}_2\text{O}_3^{2-}$ <a href="#">thiosulfate</a>
$\text{NH}_4^+$ ammonium $\text{H}_3\text{O}^+$ hydronium		-3
		$\text{PO}_4^{3-}$ phosphate

## AP Chemistry Summer Assignment

### Appendix B: Naming Practices

Polyatomic ions that don't appear on the above tables do NOT always follow these naming practices.

If you can remember the formula of the ion whose name ends with **ate**, you can *usually* work out the formulas of the other family members as follows:

modify stem name with:	meaning	examples
<b>-ate</b>	a common form, containing oxygen	chlorate, $\text{ClO}_3^-$ nitrate, $\text{NO}_3^-$ sulfate, $\text{SO}_4^{2-}$
<b>-ite</b>	one less oxygen than <b>-ate</b> form	chlorite, $\text{ClO}_2^-$ sulfite, $\text{SO}_3^{2-}$ nitrite, $\text{NO}_2^-$
<b>per-, -ate</b>	same charge, but contains one more oxygen than <b>-ate</b> form	perchlorate, $\text{ClO}_4^-$ perbromate, $\text{BrO}_4^-$
<b>hypo-, -ite</b>	same charge, but contains one less oxygen than the <b>-ite</b> form	hypochlorite, $\text{ClO}^-$ hypobromite, $\text{BrO}^-$
<b>thio-</b>	replace an O with an S	thiosulfate, $\text{S}_2\text{O}_3^{2-}$ thiosulfite, $\text{S}_2\text{O}_2^{2-}$

Some anions can capture hydrogen ions. For example, carbonate ( $\text{CO}_3^{2-}$ ) can capture an  $\text{H}^+$  to produce hydrogen carbonate  $\text{HCO}_3^-$  (often called bicarbonate). Each captured hydrogen neutralizes one minus charge on the anion.

modify stem name with:	meaning	examples
<b>hydrogen</b> or <b>bi-</b>	(1) captured $\text{H}^+$ ions	hydrogen carbonate, $\text{HCO}_3^-$ (a.k.a. bicarbonate) hydrogen sulfate, $\text{HSO}_4^-$ (a.k.a. bisulfate)
<b>dihydrogen</b>	(2) captured $\text{H}^+$ ions	dihydrogen phosphate, $\text{H}_2\text{PO}_4^-$