

Mrs. Young
WELCOME to AP Chemistry!

We will try our best to cover all of the topics and the required labs for the AP Exam that is in May. All of you will find AP chemistry to be challenging and some of you will find it to be down-right hard. There is a lot to cover and while we can do it, we will all need to work very hard. You should expect this class to be more difficult than your first chemistry class but also more relaxed and with lots of lab time. Since there is so much material to learn, we must stay on schedule to get through everything before the test. This means that we cannot slow down if you don't understand a topic.

Many students who take AP classes are also involved in other activities that will take them away from class. You need to make sure that you are staying current with all assignments, and come in for help if you are falling behind. Please communicate with me so that I can best support your efforts. I understand that you will have other things going on next year too. We need to use our class time effectively during the upcoming year, and the goal of the summer work is to review/preview material.

This summer assignment is designed to help you prepare to take AP chemistry by helping you review important chemistry and math topics that are prerequisites. Rushing through this summer assignment the day before school starts is an ineffective method for reviewing this material. Your focus should be on the learning. Students are encouraged to work together to complete the summer assignment. Think study group, not copying. You should spread out the assignment over a few weeks during the summer. You will have an opportunity to ask questions on anything in the summer assignment on the summer day.

We will discuss lab safety first thing in the fall. We will do a lab the first week of class, and you MUST get 100% on the lab safety quiz before you can participate in chemistry lab work. You will also need a notebook and binder. I will provide you with a lab notebook. This is a lab-intensive course, and we will be doing lots of labs. The College Board requires lab work to make up a minimum of 25% of our class time.

If you have any questions about any of the topics covered in this assignment, please do not hesitate to email me at youngli@lee.k12.ga.us. I will be happy to answer any questions, and I will be checking my email all summer long. I want to help you be as successful as possible in this course! I look forward to seeing all of you in the fall, and I am so excited to have you in AP chemistry!

WHY DO WE HAVE TO DO SUMMER WORK?

- It is a review of some basic content you need from the get go
- It provides the necessary fundamentals you will need to be successful in AP chemistry.
- There will not be enough time before the AP exam in May to reteach Chemistry and cover all the material tested on the AP exam
- I encourage you to take a break this summer - so, take one! In the fall we will hit the ground running!

Summer Assignment Check List

Part 1 Review AP Chemistry Course Online - Get a feel for what the course covers. Go to college board website <https://apstudent.collegeboard.org/apcourse/apchemistry> and review the course by clicking on the "AP Course Overview (PDF)" link and the "AP Chemistry Course and Exam Description (PDF)" link

Part 2: Memorize the names of the elements and their corresponding symbols • You need to know elements 1-56, plus Pt, Au, Hg, Pb, Rn, Fr, Ra, U, Pu

- Many of these elements you will already know
- Making flashcards is helpful!
- It's important to know these elements because the periodic table you are provided has only the symbols and not the names of the elements.
- Also, be familiar the charts below of polyatomic ions and common molecules-ideally, this should be memorized.

Polyatomic Ion List:

Make flashcards, take the lists with you on vacation, or do whatever it takes to get this information firmly planted.

-1	-2	-3
Acetate CH_3COO^- Hydroxide OH^- Bicarbonate HCO_3^- Nitrite NO_2^- Nitrate NO_3^- Chlorite ClO_2^- Chlorate ClO_3^- Perchlorate ClO_4^- Cyanide CN^- Thiocyanate SCN^- Hypochlorite OCl^- Iodate IO_3^- Permanganate MnO_4^-	Carbonate CO_3^{2-} Peroxide O_2^{2-} Sulfite SO_3^{2-} Sulfate SO_4^{2-} Chromate CrO_4^{2-} Dichromate $\text{Cr}_2\text{O}_7^{2-}$ Oxalate $\text{C}_2\text{O}_4^{2-}$ Silicate SiO_3^{2-} Thiosulfate $\text{S}_2\text{O}_3^{2-}$	Phosphite PO_3^{3-} Phosphate PO_4^{3-} Arsenide As^{3-}
		+1
		Ammonium NH_4^+

NH_3	Ammonia	NO	Nitric Oxide
N_2H_4	Hydrazine	N_2O	Nitrous oxide
C_2H_2	Acetylene	CH_4	Methane

Part 3: Complete the Summer Homework

- Show all units and work.
- Use dimensional analysis when directed

$$\text{Percent Error} = \left(\frac{|\text{Experimental} - \text{Theoretical}|}{\text{Theoretical}} \right) \times 100\%$$

Supplies List:

- ✓ 3- or 4-inch binder for class materials
- ✓ 1 inch binder for labs
- ✓ calculator

$$\text{K} = ^\circ\text{C} + 273.15$$

$$\text{Molarity (M)} = \frac{\text{Moles of Solute (mol)}}{\text{Volume of Solution (L)}}$$

Google Classroom Code:

wwwz76qd

Percent Error, Sig Figs, Scientific Notation

1. Calculate the percent error for the following measurements.
 - a. The density of an aluminum block determined in an experiment was 2.64 g/cm³. (Accepted value = 2.70 g/cm³)
 - b. The experimental determination of iron in ore was 16.48%. (Accepted value was 16.12%)
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. Use scientific notation to express the number 480 to
 - a. One significant figure
 - b. Two significant figures
 - c. Three significant figures
5. Perform the following mathematical operations, and express each result to the correct number of significant figures.
 - a. $97.381 + 4.2502 + 0.99195$
 - b. $171.5 + 72.915 - 8.23$
 - c. $0.102 \times 0.0821 \times 273.5$
 - d. $(9.04 - 8.23 + 21.954 + 81.0) / 3.1416$
6. 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

Dimensional Analysis

7. Precious metals and gems are measured in troy weights in the English system:
 - 24 grains = 1 pennyweight
 - 20 pennyweights = 1 troy pound
 - 1 troy pound = 12 troy ounces
 - 1 troy ounce = 0.0648 gram
 - 1 carat = 0.200 gram
 - a. Diamonds are measured in carats. If a lucky girl receives a 5-carat diamond how many pennyweights is it?

b. What is the mass of 2.3 troy ounces of gold in grams?

c. The density of gold is 19.3 g/cm^3 . What is the volume of a troy pound of gold?

8. Apothecaries (druggists) use the following set of measures:

20 grains ap = 1 scruple

3 scruples = 1 dram ap

8 dram ap = 1 oz. ap

1 dram ap = 3.888 g

a. An aspirin tablet contains $5.00 \times 10^2 \text{ mg}$ of active ingredient. How many grains ap of active ingredient does it contain?

b. From (a) how many scruples?

c. What is the mass of 1.00 scruple in grams?

9. The world record for the hundred-meter dash is 9.79 s.

a. At this speed how long would it take to run a mile (5,280 ft)?

10. You're planning to buy a new car. One model that you're considering gets 32 miles per gallon of gasoline in highway travel. The one that your spouse likes gets 14 kilometers to the liter. Which car has the better gas mileage? (1 gal = 4 qt., 1.057 qt = 1 L)

11. You pass a road sign saying "New York – 112 km".

a. If you drive at a constant speed of 65 mi/hr., how long should it take you to reach New York?

b. If your car gets 28 miles to the gallon, how many liters of gasoline are necessary to travel 112 km?

Classifying Matter Basics

12. What are some of the differences between a solid, a liquid, and a gas? Draw particle diagrams of each.

13. What is the difference between homogeneous and heterogeneous matter?

14. Classify each of the following as homogeneous or heterogeneous.

a. soil

d. gasoline

b. the atmosphere

e. gold

c. a carbonated soft drink

f. a solution of ethanol and water

15. 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

d. Iron

b. Blood

e. Brass

c. The oceans

f. Uranium

16. Distinguish between physical and chemical changes.

19. List four indications that a chemical change (reaction) has occurred.

20. 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. Also indicate if the process is endothermic or exothermic.

a. the wax

b. the wick

c. the glass rod

Periodic Table

21. Write the isotopic symbol for each of the isotopes below.

a. Atomic number = 8, number of neutrons = 9

b. The isotope of chlorine in which mass = 37

c. Atomic number = 27, mass = 60

d. Number of protons = 26, number of neutrons = 31

e. The isotope of I with a mass number of 131

f. Atomic number = 3, number of neutrons = 4

22. The element copper has naturally occurring isotopes with mass number 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.

23. 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.

24. In the periodic table, what is the name of the following groups

a. Group (1)

b. Group (3-12)

c. Group (18)

d. Group (2)

e. Group (17)

25. An ion contains 50 protons, 68 neutrons, and 48 electrons. What is its symbol and charge (Write the ion notation)?

26. Which of the following sets of elements are all in the same group in the periodic table?

a. N, P, O

b. C, Si, Ge

c. Rb, Sn

d. Mg, Ca

27. Identify each of the following elements:

a. A member of the same family as oxygen whose most stable ion contains 54 electrons

b. A member of the alkali metal family whose most stable ion contains 36 electrons

c. A noble gas with 18 protons in the nucleus

d. A halogen with 85 protons and 85 electrons

28. 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

b. Sr

c. P

d. Ba

e. I

f. O

g. Si

h. As

i. Al

j. S

29. 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

i. Br ⁻¹

b. Fe ⁺³

f. P ⁻³

j. N ⁻³

c. Ba ⁺²

g. Br ⁻¹

d. Cs ⁺¹

h. N ⁻³

30. An element's most stable ion forms an ionic compound with bromine, having the formula XBr₂. 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?

35. Write the full electron configuration of the following elements or ions:

a. Iron, Fe _____

b. Oxide ion, O⁻² _____

c. Sodium ion, Na⁺ _____

36. Write the noble gas core configuration of the following elements or ions:

a. Cesium, Cs _____

b. Gallium, Ga _____

c. Xenon, Xe _____

Periodicity

37. Atomic Radius

a. Define Atomic Radius –

b. What happens to the attractive forces between two oppositely charged particles as the distance between the particles increases?

c. What happens to the attractive forces between outer valence electrons and the nucleus as more protons are added to the nucleus?

d. Which atom has the largest atomic radius, Li, Na, or K? Explain in terms of nuclear charge and energy levels.

- e. Which atom has the smallest radius, Ca, Cu, or As? Explain in terms of nuclear charge and energy levels.
- f. A student claims that F has the smallest radius of O, F, and Cl. Do you agree or disagree? Explain why or why not.

38. Ionization Energy

- a. Define Ionization Energy –
- b. Which atom has the smallest ionization energy, Beryllium Be, Magnesium Mg, or Calcium Ca? Explain.
- c. Which atom has the largest ionization energy, Phosphorus P, Sulfur S or Chlorine Cl? Explain in terms of nuclear charge and valence electrons.
- d. A student claims Nitrogen will have the smallest ionization energy of C, N, and P. Do you agree or disagree? Explain why or why not.

39. Electronegativity

- a. Define electronegativity –
- b. Which atom has the largest electronegativity nitrogen, oxygen, or fluorine? Explain in terms of atomic structure.
- c. Which atom has the smallest electronegativity Lithium, sodium, or potassium? Explain in terms of atomic structure.
- d. Which atom O, F, or Cl has the largest electronegativity? Explain in terms of atomic structure.

Writing Formulas and Naming Compounds

40. Name each of the following compounds:

a. NaCl

h. AlI_3

o. BaSO_3

b. Rb_2O

i. Al_2O_3

p. KMnO_4

c. FeBr_3

j. ZnCl_2

q. Sr_3P_2

d. Cr_2O_3

k. Li_3N

r. $\text{Ca}_3(\text{PO}_4)_2$

e. CaBr_2

l. Ag_2S

s. $\text{Pb}(\text{NO}_3)_2$

f. CsF

m. KClO_4

t. NaNO_2

g. CaS

n. $\text{Al}_2(\text{SO}_4)_3$

u. $\text{K}_2\text{Cr}_2\text{O}_7$

41. Name each of the following molecules:

a. NI_3

i. SiO_2

b. PCl_3

j. XeF_6

c. SO_2

k. CH_4

d. N_2O_4

l. NH_3

e. ICl_3

m. O_2

f. SF_2

n. N_2

g. N_2F_4

o. C_2H_2

h. P_2S_5

p. C_2H_4

42. Name each of the following acids or bases:

a. HCl

e. CaCO_3

h. NH_3

b. H_3PO_4

f. $\text{Al}(\text{OH})_3$

i. H_2SO_4

c. H_2SO_3

g. NaOH

j. NaHCO_3

d. $\text{HC}_2\text{H}_3\text{O}_2$

43. Write the formula for each of the following compounds/molecules and acids:

a. Cesium bromide

n. Sulfur difluoride

aa. Lead (IV) sulfide

b. Barium sulfate

o. Sulfur hexafluoride

bb. Copper (I) chloride

c. Chlorine trifluoride

p. Sodium dihydrogen phosphate

cc. Cadmium selenide

d. Ammonium chloride

q. Silicon tetrachloride

dd. Zinc sulfide

e. Beryllium oxide

r. Lithium nitride

ee. Ammonium hydrogen phosphate

f. Chlorine monoxide

s. Chromium (III) carbonate

ff. Hydrobromic acid

g. Magnesium fluoride

t. Tin (II) fluoride

gg. Bromous acid

h. sodium oxide

u. Ammonium acetate

hh. Perchloric acid

i. Sodium peroxide

v. Ammonium hydrogen sulfate

ii. Silicon dioxide

j. Potassium cyanide

w. Cobalt (III) nitrate

jj. Sodium sulfate

k. Copper (II) nitrate

x. Copper (I) sulfide

kk. Aluminum hydrogen sulfate

l. Silicon tetrafluoride

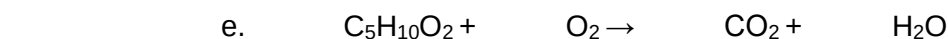
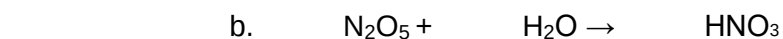
y. Potassium chlorate

m. Lead (II) sulfide

z. Lithium borate

Equations & Reactions Types

44. Balance the following equations and identify the type of reaction present:



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

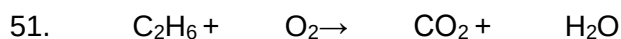
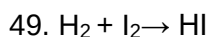
45. When solid potassium chlorate is heated it decomposes to form solid potassium chloride and oxygen.

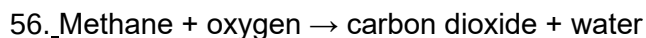
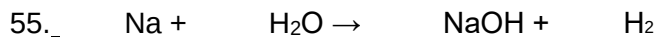
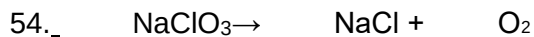
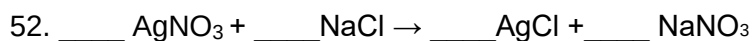
46. Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.

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

48. When hydrogen sulfide gas is passed over solid hot iron (III) hydroxide, the resultant reaction produces solid iron (III) sulfide and water vapor.

Indicate what type of reaction is represented in the following equations. Write and balance the equations also. A. Synthesis B. Decomposition C. Redox D. Double replacement E. Combustion F. Acid/Base





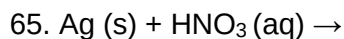
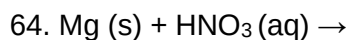
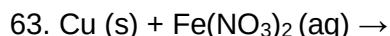
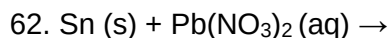
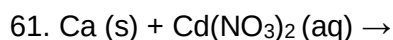
States in Reactions:

- (s): solid
- (l): liquid
- (g): gas
- (aq): aqueous or hydrated or in water

Practice: In the following reactions, identify the precipitate and write the complete and net ionic equations including states.



For the following reactions, use the **Activity Series of Metals** to determine if a reaction will occur and if so, what the products will be. If no reaction will occur, write NR for the product. **Balance the equations if applicable.**



F. Mole Conversions – use dimensional analysis to solve.

66. 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 grams of aspartame?

Most Reactive	
POTASSIUM	¹⁹ K
SODIUM	¹¹ Na
CALCIUM	²⁰ Ca
MAGNESIUM	¹² Mg
ALUMINUM	¹³ Al
CARBON	⁶ C
ZINC	³⁰ Zn
IRON	²⁶ Fe
TIN	⁵⁰ Sn
LEAD	⁸² Pb
HYDROGEN	¹ H
COPPER	²⁹ Cu
SILVER	⁴⁷ Ag
GOLD	⁷⁹ Au
PLATINUM	⁷⁸ Pt
Least Reactive	

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

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

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

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

69. What is the mass, in grams, of 2.69×10^{23} molecules of aspirin, $C_9H_8O_4$?

70. What is the molar mass of diazepam (Valium) if 0.05570 mol has a mass of 15.86 g?

71. What is the volume occupied by each of the following gases at STP?

a. 10.0g of $H_2S(g)$

c. 5.0×10^{20} molecules of $BrF(g)$

b. 15.0mg of $SbH_3(g)$

d. 8.5×10^{25} molecules of $B_2H_6(g)$

72. What is the mass of each of the following?

a. 1 atom of Au

c. 250.0mL of $C_3H_6(g)$ at STP

b. 1.5×10^{15} molecules of AgCl

d. 2.00L of $SF_6(g)$ at STP

73. How many moles are in each of the following?

a. 5.00g of $C_{10}H_8$

d. 1.00mL of O_3 at STP

b. 525mg of K_3PO_4

e. 4.55×10^{12} atoms of Pt

c. 6.00L of $NO_3F(g)$ at STP

f. 6.022×10^{16} molecules of PCl_5

74. Answer the following questions showing all your work.

a. How many atoms are there in 2 molecules of $Hg(IO_3)_2$?

b. What is the volume occupied by 1.45×10^{30} molecules of COF_2 at STP?

c. How many molecules are there in 64.0g of $FeS(s)$?

- d. How many moles are in 25.0mL of HCN(g) at STP?
- e. What is the volume occupied by 43.5g of ClF₃ at STP?

- f. How many moles are in 2.75×10^{23} atoms of Fe?

- g. How many molecules are there in 125mL of NOCl(g) at STP?

- h. What is the mass of 3.011×10^{22} atoms of Pt?

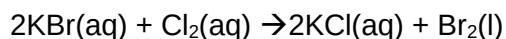
- i. What is the molar mass of HClO₄ · 2H₂O?

- j. What is the mass of 25.0mL Kr(g) at STP?

- k. What is the molar volume of iridium metal, Ir? (density = 22.42g/mL)

Limiting Reactant & Percent Yield

75. Determine the grams of sodium chloride produced when 10.0 g of sodium react with 10.0 g of chlorine gas.
76. Determine the mass of lithium hydroxide produced when 50.0g of lithium are reacted with 45.0g of water.
77. Determine the percent yield of water produced when 68.3 g of hydrogen reacts with 85.4g of oxygen and 86.4g of water are collected.
78. Chlorine can replace bromine in bromide compounds forming a chloride compound and elemental bromine. The following equation is an example of the reaction:



(a) When 0.855g of Cl_2 and 3.205g of KBr are mixed in solution, which is the limiting reactant?

(b) How many grams of each product are formed?

(c) How many grams of the excess reactant remain after the reaction is complete?

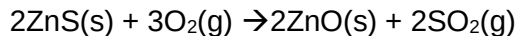
79. A process by which zirconium metal can be produced from the mineral zirconium (IV) orthosilicate, ZrSiO_4 , starts by reacting it with chlorine gas to form zirconium (IV) chloride.



What mass of ZrCl_4 can be produced if 862g of ZrSiO_4 and 950.g of Cl_2 are available? (You must first determine limiting reactant).

80. In the reaction $\text{BaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ba}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$, what mass of $\text{Ba}(\text{NO}_3)_2$ can be formed by combining 55g BaCO_3 and 26g HNO_3 ?

81. Huge quantities of sulfur dioxide are produced from zinc sulfide by means of the following reaction.



If the typical yield is 86.78%, how much SO_2 should be expected if 4897g of ZnS are used?

Molarity

82. How many moles HCl is in a 10 mL solution of 0.6 M HCl?

83. What is the molarity of a 15 mL solution with 0.01 moles of KOH?

84. What is the volume needed to make 4 M HNO_3 with 2 moles of acid?

85. You're titrating HCl with 0.1 M NaOH. What is the concentration of HCl if the equivalence point is at 10 mL?

86. How much 0.25 M NaOH is necessary to neutralize 75 mL of 0.7987 M HI?

87. How many grams of potassium fluoride are in 2 liters of a 3.0 M solution of potassium fluoride?

88. How many grams of ammonia are dissolved in 85 mL of a 0.75 M solution?

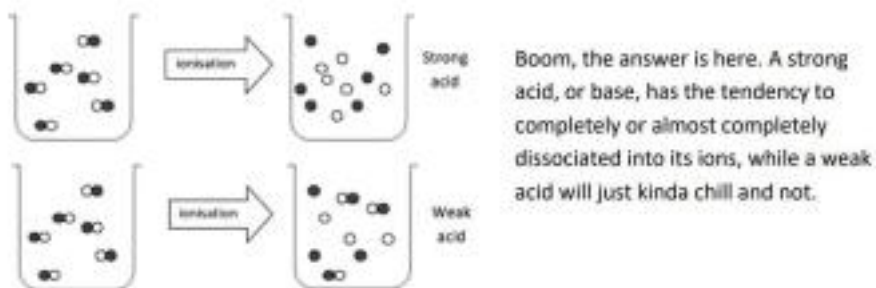
89. The tanks in our classroom contain 34 grams of sodium chloride per liter. What is the molarity of the saltwater?

90. What is the molarity of 245.0 g of H_2SO_4 dissolved in 1.000 L of solution?

91. What is the molarity of 5.30 g of sodium carbonate dissolved in 400.0 mL solution?

92. How many moles of sodium phosphide are contained in 100.0 mL of a 0.200 M solution?

Acids/Bases



Boom, the answer is here. A strong acid, or base, has the tendency to completely or almost completely dissociated into its ions, while a weak acid will just kinda chill and not.

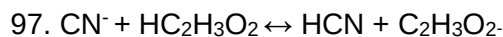
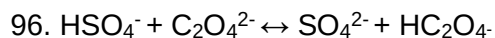
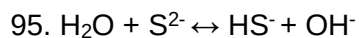
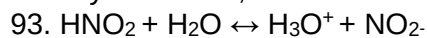
Brønsted-Lowry Acids and Bases: An acid is a hydrogen donor, while a base is a hydrogen receiver.

Example: adding Hydrochloric Acid (HCl) to water will cause the HCl to donate its proton (H^+) to water, making it a Brønsted-Lowry Acid.

Characteristics of Acids and Bases:

Acids: 1 - 6.9999 pH, they taste sour, they increase H^+ in water. Bases: 7.0001 - 14 pH, bitter, increases OH

Identify each acid, and base.



Complete the equation for each of the following acid-base reactions.

