

**AP Chemistry Summer Homework 2017-2018**

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**Directions:** This is a foundational chapter included in the AP Chemistry curriculum in Big Ideas 1, 2, and 3 along with mathematical concepts found in Big Ideas 4, 5, and 6. Many of these concepts and skills should be familiar topics from previous science classes.

**1.1 Atoms and Molecules**

1. Give an example of a substance made entirely of only atoms.
2. Give an example of a substance made of molecules.
3. What is the difference between an atom and a molecule?

**1.2 The Scientific Approach to Knowledge—Read only****1.3 Classification of Matter: Solid, Liquid, and Gas**

4. Explain what a volatile substance is and how to determine if a substance is volatile.
5. Define each of the following techniques used in separating mixtures: decanting, distillation, and filtration. Give an example of a use for each technique.
  - a. Decanting
  - b. Distillation
  - c. Filtration

**1.4 Physical and Chemical Changes and Physical and Chemical Properties**

6. What is a physical change? Give three examples.
7. What is a chemical change? Give three examples.
8. How can you tell the difference between a physical change and a chemical change?
9. What is a physical property? Give three examples.

10. What is a chemical property? Give three examples.

11. How can you tell the difference between a physical property and a chemical property?

### 1.5 Energy: A Fundamental Part of Physical and Chemical Change—Read Only

### 1.6 Units of Measurement

12. For each quantity in the chart below, give the SI unit and symbol

Quantity	Temperature	Time	Length	Mass	Amount of Substance	Electric Current
Unit						
Symbol						

13. How do you convert from a temperature in degrees Celsius to a temperature in Kelvin?

14. What is the relationship between mass and volume of a substance?

### 1.7 The Reliability of a Measurement

15. Explain how to determine the number of significant figures in a measurement.

16. State the number of significant figures in the following measurements.

a. 1.00350 g

b. 1.0020 g

c. 240 g

17. Explain how to determine the number of significant figures in the final result of a calculation using multiplication or division.

18. Explain how to determine the number of significant figures in the final result of a calculation using addition or subtraction.

### **1.8 Solving Chemical Problems**

19. How would you set up a problem to convert 37.0 mL to L?

20. Show how to set up a problem to convert 0.075 km/hr to m/s. Use dimensional analysis.

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This chapter is foundational to concepts in AP Chemistry curriculum in Big Ideas 1 and 3. These two big ideas discuss the building materials of matter and changes in matter. To understand the development of our current knowledge about atoms, we must understand how our ideas came to be. While reading, pay particular attention to data or observations leading to the change in an understanding, or in the development of a new concept.

**2.1 Imaging and Moving Individual Atoms - read only****2.2 Early Ideas About the Building Blocks of Matter - read only****2.3 Modern Atomic Theory and the Laws that Led to It**

1. Fill in the following table

Law or Theory	Scientist	Data to Support
Law of Definite Proportions		
Law of Multiple Proportions		
Atomic Theory		

**2.4 The Discovery of the Electron**

2. Fill in the following chart

Scientist	Discovery	Experiment and Data to Support
J.J. Thompson		
Robert Millikan		

## 2.5 Structure of the Atom

3. Fill in the following chart

Subatomic Particle Found	Scientist	Experiment	Data Supporting Discovery

## 2.6 Subatomic Particles: Protons, Neutrons, and Electrons in Atoms

4. Define the following terms in your own words.

a. Atomic mass unit

b. Atomic number

c. Isotopes

d. Ion

5. What is the difference between a cation and an anion? Give an example of each.

6. Explain how to calculate or find the mass number for an atom.

7. Fill in the following table of subatomic particles

Particle	Relative Charge	Mass (g)	Mass (amu)	How to calculate?
Proton				
Neutron				
Electron				



15. Label the following periodic table to show where to find alkali metals, alkaline earth metals, halogens, transition metals, and noble gases.

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16. Explain how to use the periodic table to predict the charge usually observed for a monatomic ion.

### 2.8 Atomic Mass: The Average Mass of an Element's Atoms

17. Explain what isotopes are. How do you write a symbol for an isotope?
18. Explain how isotopes can be the same element, yet be different.
19. Explain atomic mass. How is this different from the atomic mass number?
20. What is mass spectrometry and what is it used for?
21. You will be expected to answer questions on mass spectroscopy on the AP Chemistry Exam. Here are some questions you should try, and be able to explain: #15 on p. 76 (self-assessment), 101 & 102 on p. 82.

## 2.9 Molar Mass: Counting Atoms by Weighing Them

22. What does Avogadro's number represent?

23. A pure silver ring contains  $2.80 \times 10^{22}$  silver atoms. How many moles of silver atoms does it contain? *Show your work using dimensional analysis.*



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Chapter 3 contains concepts from Big Ideas 1, 2, and 3 in the AP Chemistry curriculum. These concepts are foundational to all Big Ideas. Naming compounds, balancing equations, and mathematical problem solving are important skills to master. Differentiating between the different types of compounds by name or by formula will be important in later chapters and on the AP Chemistry exam. Applications of concepts addressed in the cross domains of the AP science practices are also included in this reading guide.

**3.1 Hydrogen, Oxygen, and Water—Read Only****3.2 Chemical Bonds**

1. What two basic components of atoms are responsible for chemical bonding?
2. Name the two main types of chemical bonds.
3. Ionic bonds are formed between what types of elements?
4. Covalent bonds are formed between atoms in what general class of elements?
5. Explain which types of elements form the anion and the cation in an ionic bond.
6. What holds an ionic bond together?
7. Explain what a molecule is.
  - a. Identify an element consisting of molecules.
  - b. Identify a compound consisting of molecules.

### 3.3 Representing Compounds: Chemical Formulas and Molecular Models

- Using an example, explain the differences between a structural formula, an empirical formula, and a molecular formula.

### 3.4 An Atomic-Level View of Elements and Compounds

- Explain what the term HONClBrIF means.
- Explain why ionic compounds are not called molecules.
- What is a formula unit and when is the term useful?
- What is a polyatomic ion? Give an example of one polyatomic cation and one polyatomic anion. Show how these two ions combine to form a compound.

### 3.5 Ionic Compounds: Formulas and Names

- Summarize the three steps in writing the formula for an ionic compound.
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  -
- Explain how to name an ionic compound composed of a cation that can form more than one type of ion ( $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$ , for example).

15. Do problems 37 and 38 on page 131.

16. Do problem 41 on page 131.

17. Do problems 43 and 44 on page 131, a → d only.

18. What are oxyanions?

19. Fill in the following chart for oxyanions formed by bromine and oxygen atoms

<b>Ionic Ending</b>	<b>Per_____ate</b>	<b>_____ate</b>	<b>_____ite</b>	<b>Hypo_____ite</b>
Formula		Bromate $\text{BrO}_3^-$		
# of oxygen atoms compared to the -ate ending		same		

20. What are hydrates, and how are waters of hydration indicated in a formula?

21. Fill in the following chart on the prefixes used in naming to identify the number of waters in a hydrate

1	2	3	4	5	6	7	8	9

### 3.6 Molecular Compounds: Formulas and Names

22. What is the basic format used in naming a binary molecular compound?

23. Fill in the following table with the prefixes used in molecular compound naming:

1	2	3	4	5	6	7	8	9	10

45. What are acids?

46. What are three properties or characteristics of acids?

a.

b.

c.

47. What are the two main types of acids?

a.

b.

**3.7 Summary of Inorganic Nomenclature—Review the inorganic nomenclature chart and example 3.11 on page 106.**

### 3.8 Formula Mass and the Mole Concept for Compounds

48. Show how to calculate the molar mass of  $\text{HClO}_4$ .

49. Calculate the following. Be sure to show all of your work and label all quantities with the correct units. Use dimensional analysis methods.
- How many molecules of  $\text{CO}_2$  are contained in a sample of 43.5 g of  $\text{CO}_2$ ?
  
  
  
  
  
  
  
  
  
  
  - How many oxygen atoms and carbon atoms are present in the sample?

### 3.9 Composition of Molecules

50. What is mass percent?
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51. Calculate the mass percent of hydrogen in water. Show all work.
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52. Show how to calculate the empirical formula of a compound using 42.88% C and 57.12% O.

### 3.10 Determining a Chemical Formula from Experimental Data

53. If the combustion of a hydrocarbon forms 1.60 g of carbon dioxide and 0.819 g of water, write out a conceptual plan and indicate the relationships needed to calculate the empirical formula of the hydrocarbon.
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54. Do question 87 on page 133. The answer is in the back of the book, so you can check your work.

### 3.11 Writing and Balancing Chemical Equations

55. Explain what is meant by a balanced chemical equation.

56. Balance the following chemical reaction, which represents the decomposition of hydrazine.



57. Explain the difference between a coefficient and a subscript in a chemical equation. Use an example to illustrate your answer.

58. Answer question 105 (page 134) to review your skills in interpreting chemical equations.

59. Answer question 109 (page 134) to practice balancing equations.

### 3.12 Organic Compounds—Read this section.

60. Answer Question 111 on page 134.