

Advanced Placement (AP) Chemistry Review Summer Assignment

Hello future AP Chemistry student!

Welcome to AP Chemistry! I am looking forward to helping you gain a deeper appreciation for the science of chemistry and how it impacts our lives. I hope you are looking forward to an exciting and challenging year. This course can be quite difficult at times, but with hard work and determination, there is no reason you cannot excel in this course! Your hard work will pay off, and I hope you will find AP Chemistry to be a very rewarding experience!

The Advanced Placement Chemistry class is designed to provide a full year of college-level chemistry. So, it places heavy demands on the student, especially in terms of the time commitment required. In fact, the College Board suggests that students devote a **minimum of five hours per week** for individual study outside of the classroom. The ultimate objective, of course, is to prepare you to take the AP Chemistry test in May, and in order to accomplish this, topics are covered VERY quickly. For this reason, most students take AP Chemistry after they have already completed a year of high school chemistry, since that provides them with a foundation. In order to ensure the best start for you this year, I have prepared a **Summer Assignment** that reviews many basic chemistry concepts. This is a required assignment. It is designed to let you know where you might have weaknesses in the fundamentals of chemistry needed for the AP Chemistry course.

If you have already taken a high school chemistry course, you will find much of the material in the Summer Assignment to be very familiar. However, if you will be taking AP Chemistry as your first high school chemistry course, the problems in the Review Assignment will help you build a foundation in chemistry and contribute to your success. Extensive remediation is not an option as we work towards our goal of becoming completely prepared for the AP Exam in early May, so seek help early if you are floundering.

I recommend that you work throughout the summer on the Summer Assignment, rather than trying to complete it right before it is due, which will be shortly after the first day of class. It takes time for a student to process, practice, and subsequently master chemistry at the level necessary for success in AP Chemistry. Remember, AP Chemistry is **equivalent to a General Chemistry** college course, a full year lecture program plus labs! Taking a college level course in high school is difficult, and it **requires commitment, hard work, and time**, but completion of a class like this is a **great investment** in your education. Prepare yourself and arrive ready to learn!

Study Suggestions

You need to be prepared to really dig deep into a textbook. Not everything can be covered in depth in the class, we just do not have enough time. As such, you will be expected to facilitate and supplement your own learning of the material, whether that be reading through the textbook and taking notes, completing more than the practice problems assigned in the textbook, seeking out extra practice problems, or seeking additional resources of learning such as Kahn Academy or the UT Austin general chemistry website. I am always here to help mentor and guide you, but the amount of material we are expected to cover is staggering and the pace of this class will be fast and furious! If you are not doing all you can outside of class to help aid your understanding, you can easily get steamrolled!

Useful links:

- www.apchemistrynmsi.wikispaces.com/home
- www.tdwscience.com (Tyler DeWitt Videos)
- www.brightstorm.com/science/chemistry
- www.chemmybear.com
- www.adriandindleschemistrypages.com
- www.khanacademy.org/#Chemistry
- www.bozemanscience.com/ap-chemistry/
- <https://gchem.cm.utexas.edu/> (UT Austin Chem Site)
- <http://education-portal.com/academy/course/general-chemistry-course.html>

Textbook:

In this class, we will use:

Gilbert, Kirss, Bretz, and Foster's *Chemistry: An Atoms-Focused Approach*, First AP Edition, 2021 (the cover is bright yellow with and it should say 'AP edition' on it).

It is highly recommended that you purchase this book as we will regularly have homework assigned from it! That said, I know textbooks can be pricey, and not all families are willing/able to purchase one for a single class. For this reason, all homework problems will be scanned from the book so that those without a copy can still complete them. However, I would still strongly suggest that you go to a used bookstore or go online and purchase the above textbook, or at least SOME AP level chemistry textbook. It will be very difficult to do well in the class without something to reference when material becomes extremely difficult.

Advanced Placement Chemistry - Summer Review Packet

TASK 1: Learning Targets

- Complete Learning Targets 1-14. **Be sure to show all work on a separate sheet of paper.** Each learning target includes pages of the recommended textbook that target, and what to search for in online resources to help you review the material.
- This will be due shortly after the first day of class

TASK 2: Elements and Their Symbols

- Memorize the names of the elements and their corresponding symbols.
- There will be quizzes during the first weeks of class.
- You need to know the atomic symbols and names of elements 1-36, plus Rb, Cs, Fr, Sr, Ba, Ra, Pd, Pt, Ag, Au, Sn, Pb, Bi, I, At, U, Pu, Xe, and Rn

TASK 3: Ions and Their Charges

- Memorize the ionic charges of the basic ions.
- There will be quizzes during the first weeks of class.
- Think about the valence electrons!
- Think about the common elements/ions in that group
 - Group 1 ions = +1
 - Group 2 ions = +2
 - Group 15 ions (N and P) = -3
 - Group 16 ions (O and S) = -2
 - Group 17 ions (halogens) = -1
 - Al = +3, Zn = +2; Ag = +1

TASK 4: Polyatomic Ions and Their Symbols & Charges

- Memorize the names, symbols, and charges of the polyatomic ions below.
- There will be quizzes during the first weeks of class.
 - Oxyanions – polyatomics containing oxygen, names end in *-ate* or *-ite*.
 - *-ate* is used for the most common form.
 - *-ite* is used for the form with the same charge, but one less oxygen
 - Examples: NO_3^{1-} is nitrate while NO_2^{1-} is nitrite.
 - Prefixes are also used
 - *Per-* indicates one more oxygen than the *-ate* form.
 - *Hypo-* indicates one fewer oxygen than the *-ite* form.
 - Examples:
 ClO_4^{1-} = perchlorate
 ClO_3^{1-} = chlorate
 ClO_2^{1-} = chlorite
 ClO^{1-} = hypochlorite

- F, Cl, Br, I all behave the same
 - Therefore, if chlorate is ClO_3^{1-} , the bromate ion is BrO_3^{1-}
 - If you learn the chlorate series, you also automatically know the bromate, iodate, and fluorate series.
- Hydrogen can be added to -2 or -3 ions to make a “new ion” i.e. $\text{H}_2\text{PO}_4^{1-}$ is dihydrogen phosphate (note the negative charge went up 1 for each H^+ added)

LEARNING TARGETS

Learning Target 1 – I can determine the number of significant figures in a measurement.

Review Reading: Pages 22-26

Wikipedia: Follow link above and search for “Significant Figures”

Tyler DeWitt Chemistry Videos: Follow link above and search for “Significant Figures”

1) Determine the number of significant figures in the following measurements:

- a) 2.71 g _____ b) 0.00047 kg _____ c) 7.0×10^5 m _____ d) 1030 L _____
- e) 150 pencils _____ f) 37500 g _____ g) 0.1010 cm _____

Learning Target 2 – I can convert numbers to scientific notation while applying significant figures.

Review Reading: Pages 22-26

Wikipedia: Search “Significant Figures”

Tyler DeWitt Chemistry Videos: Search “Significant Figures”

2) Express each of the following in proper scientific notation (pay attention to sig figs and units).

- a) 0.000125 m _____ b) 155.0 mL _____
- c) 123,030,000 kg _____ d) 481.9×10^{-9} cm _____

Learning Target 3 – I can add, subtract, multiply, and divide with the correct number of significant figures.

Review Reading: Pages 22-26

Wikipedia: Search “Significant Figures”

Tyler DeWitt Chemistry Videos: Search “Significant Figures”

3) Calculate the correct answer with proper units and sig figs for each of the following:

- a) $12 \text{ g} + 0.677 \text{ g} + 86.33 \text{ g} =$ _____ b) $(355.78 \text{ g}) / (0.056 \text{ g}) =$ _____
- c) $97.34 \text{ mL} - 34.1 \text{ mL} =$ _____ d) $14.68 \text{ m} \times 5 \text{ m} =$ _____

4) Perform the following calculations with scientific notation and report your answer with the correct number of significant figures.

a) $0.14 \times (6.02 \times 10^{23}) =$ _____

b) $\frac{(9.875 \times 10^4) - (9.795 \times 10^4)}{9.875 \times 10^4} \times 100 =$ _____ (assume that 100 is an exact number.)

c) $(3.8 \times 10^{-12} + 4.0 \times 10^{-13}) = \underline{\hspace{2cm}}$
 $(4 \times 10^{12} + 6.3 \times 10^{13})$

Learning Target 4 – I can use conversion factors to solve dimensional analysis problems.

Review Reading: Pages 26-31

Khan Academy: Follow Link Above and Search “Dimensional Analysis”

Tyler DeWitt Chemistry Videos: Search “Unit Conversions”

5) Solve the following problems using dimensional analysis.

a) A large railroad car is filled with 1745 gallons of milk. The car springs a leak in the bottom, and milk starts dripping out at a rate of 204.84 mL/sec. If the train is traveling at a speed of 65.4 miles per hour, calculate how many miles it will travel before all the milk has drained out of the car.

(1 gal = 3.78 L, 1 mile = 5280 ft, 1 in = 2.54 cm)

b) The world record for the hundred-meter dash is 9.77 seconds. What is the corresponding average speed in units of m/sec, km/hr, ft/sec, and miles/hour?

Learning Target 5 – I can explain density and use the density equation to find an unknown.

Review Reading: Pages 8-10

Khan Academy: Search “Density”

6) A rectangular block has dimensions of 2.9 cm x 3.5 cm x 10.0 cm. The mass of the block is 615.0 grams. What is the volume and the density of the block?

7) The density of pure silver is 10.5 g/mL at 20°C. If 5.25 grams of pure silver pellets are added to a graduated cylinder containing 11.2 mL of water, to what volume will the water in the cylinder rise?

Learning Target 6 – I can define and explain terms that identify physical/chemical characteristics of matter.

Review Reading: Pages 8-17

Wikipedia: Search “Matter”

8) Define the following terms:

a) solid –

e) homogeneous mixture –

b) liquid –

f) heterogeneous mixture –

c) gas –

g) chemical change –

d) pure substance –

h) physical change –

9) Identify the following as a physical property, physical change, chemical property, or chemical change.

a) Ethanol has a density of 0.697 g/mL.

b) The solution turns blue upon mixing water and food coloring.

c) Wood burns in an oven.

d) Methyl alcohol is highly flammable.

e) Ice melts in a beaker.

f) Methyl ethanoate smells like apples.

g) A car crashes into a wall.

h) Sugar dissolves in water.

Learning Target 7 – I can identify the number of protons, neutrons, and electrons in atoms and isotopes.

Review Reading: Pages 52-56

Tyler Dewitt Chemistry Videos: Search “Isotope”

10) What number of protons and neutrons are contained in the nucleus of each of the following atoms?

Assuming each atom is uncharged, what number of electrons are present?

a) ^{235}U

b) ^{13}C

c) ^{57}Fe

d) ^{208}Pb

Protons

Neutrons

Electrons

11) Complete the following table:

Name	Mass #	Atomic #	# of Protons	# of Neutrons	# of Electrons	Symbol
Gallium-	70					
						$^{31}\text{P}^{-3}$
Strontium-80						
						$^{55}\text{Mn}^{+2}$

Learning Target 8 – I can define and use the Law of Definite Proportions and the Law of Multiple Proportions.

Review Reading: Pages 5-9 and 312-319

Khan Academy: Search “Laws of Definite and Multiple Proportions”

12) Explain:

a) Law of Definite Proportions:

b) Law of Multiple Proportions:

13) Solve the following problem:

Tin – Oxygen Compound	Tin % by mass	Oxygen % by mass
Stannous oxide	88.10%	11.90%
Stannic oxide	78.70%	21.30%

Tin – Oxygen Compound	Tin mass	Oxygen mass
Stannous oxide	100.0 g	
Stannic oxide	100.0 g	

a) Use the Law of Definite Proportions to determine the mass of oxygen needed to combine with the given masses of tin for stannous oxide and stannic oxide.

b) Does the Law of Multiple Proportions hold true in this case? Explain why or why not.

Learning Target 9 – I can name and write formulas for ionic and molecular compounds.

Review Reading: 154-160

Tyler Dewitt Chemistry Videos: Search "Chemical Formulas"

14) Name or give the formula for the following compounds:

Name	Formula
Sodium fluoride	
	K ₂ O
Calcium phosphate	
	FeCl ₃
Iron(II) chloride	
	SnO ₂
Copper(II) nitrate	

Name	Formula
	SO ₂
Sodium sulfate	
	CaCO ₃
Lithium phosphate	
	Zn(NO ₃) ₂
Calcium hydroxide	
	Na ₂ SO ₄

Name	Formula
Sulfuric acid	
	HNO ₃
Phosphorus pentabromide	
	N ₂ O ₅
Hydrochloric acid	
	HClO ₃

Learning Target 10 – I can write and balance chemical equations.

Review Reading: 293-303

Tyler Dewitt Chemistry Videos: Search "Chemical Reactions"

15) Identify the type of reaction and write the balanced chemical equations (include states of matter):

a) Iron metal reacts with oxygen to form rust, iron(III) oxide.

b) Calcium metal reacts with water to produce aqueous calcium hydroxide and hydrogen gas.

c) Aqueous barium hydroxide reacts with aqueous sulfuric acid to produce solid barium sulfate and water.

16) Identify the type of reaction and write the balanced chemical equations (include states of matter):

a) Solid magnesium is heated in the presence of nitrogen gas to form magnesium nitride.

b) Aluminum foil is added to a solution of copper(II) chloride. Solid copper and aluminum chloride forms.

c) A solution of lead(II) nitrate is added to a solution of sodium sulfate and a precipitate forms.

d) Solid potassium chlorate is heated until it breaks down into potassium chloride and oxygen gas.

e) Propane gas is burned.

Learning Target 11 – I can do conversions associated with moles.

Review Reading: Pages 303-306

Tyler Dewitt Chemistry Videos: Search “Moles”

17) Solve the following problems:

- | |
|---|
| a) Calculate the mass of 500. atoms of iron (Fe). |
| b) How many formula units are present in 87.2 g of lead(IV) carbonate? |
| c) Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed as Nutra-Sweet. The molecular formula of aspartame is $C_{14}H_{18}N_2O_5$. |
| i) Calculate the molar mass of aspartame. |
| ii) Calculate the mass, in grams, of 1.56 mol of aspartame. |
| iii) How many molecules are in 5.0 mg of aspartame. |
| iv) How many atoms of nitrogen are in 1.2 g aspartame? |
| v) What is the mass of one molecule of aspartame? |

Learning Target 12 - I can calculate percent by mass for an element in a compound.

Review Reading: Pages 312-319

Tyler Dewitt Chemistry Videos: Search “Percent Composition”

18) Calculate the percent by mass for each element in aspartame from the previous problem.

C -	
H -	
N -	
O -	

Learning Target 13 – I can calculate the average atomic mass of an isotope using percent abundance.

Review Reading: Pages 70-73

Tyler Dewitt Chemistry Videos: Search “Atomic Mass”

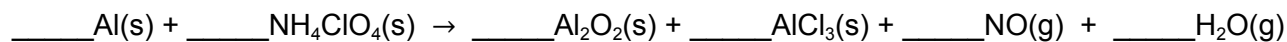
- | |
|--|
| 19) An element consists of 1.40% of an isotope with a mass of 203.973 amu, 24.10% of an isotope with a mass of 205.9745 amu, 22.10% of an isotope with a mass of 206.9759 amu, and 52.40% of an isotope with a mass of 207.9766 amu. Calculate the average atomic mass and identify the element. |
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Learning Target 14 – I can solve stoichiometry problems, including those that use limiting and excess.

Review Reading: Pages 306-312

Tyler Dewitt Chemistry Videos: Search "Stoichiometry"

20) The reusable booster rockets of the U.S. space shuttle employs a mixture of aluminum and ammonium perchlorate for fuel. A possible reaction for this is:



a) If 4.0 g of aluminum reacted with 15.0 g of ammonium perchlorate, what would be the limiting reactant? How much excess of the other reactant would you have after the reaction?

b) How much aluminum chloride would be produced in grams?

c) If you actually collected 4.18 g of aluminum chloride what would be your percent yield?

21) You add aluminum to a solution of copper(II) chloride and it reacts exothermically. Write a balanced chemical equation.

a) If you react 1.25 g of Al, how much copper(II) chloride do you need to add for the aluminum to fully react?

b) How much of each product would you collect?

22) When 125.0 g of ethylene (C_2H_4) burns in 60.0 grams of oxygen to give carbon dioxide and water, how many grams of CO_2 are formed? (Hint: Write a balanced chemical equation and determine the limiting reactant first.)