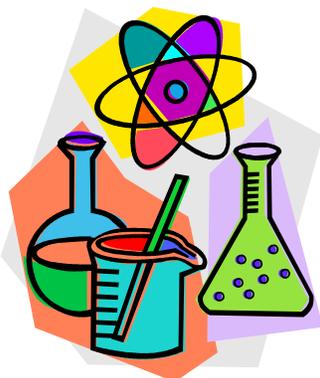


# *AP Chemistry*



## *Review Assignment*

- Read the letter on the next page.
- Complete the following worksheets in this packet.
- Buy an AP Chemistry Test Prep book (like from the Princeton Review OR Barron's OR 5 Steps to a 5) and start looking through it.
- Email me with questions  
([jonathan.gambrell@cobbk12.org](mailto:jonathan.gambrell@cobbk12.org))

# WELCOME TO AP CHEMISTRY! ☺

I am excited you have chosen take AP Chemistry. The class will be challenging, but the biggest factor in determining your success will be the amount of effort you put into the class. If you do the homework and take the time to prepare outside of class, you can definitely be successful in the class and ultimately on the AP exam.

We have a lot of material to cover in this class, so we will start off by making sure that we all have the basics down. **Over the winter break, you are responsible for doing the worksheets in this review packet. You will have a test on this material at the end of the first week of school.** The material in this packet should be mostly review from Honors Chemistry. You will find that much of the AP Chemistry curriculum consists of the same topics that you covered last year, but in more depth. Because this is a college level class, you will need to be aware of the rigor that this course poses and be prepared to handle the advanced content.

If you get stuck on a problem or a certain type of problem, try moving on to the next part. These problems cover a wide variety of topics, so you might be able to do the next part and then go back to the previous ones later. I am also including a copy of your new periodic table. This is the version that is provided on the AP exam, so you should start getting used to it. You might notice that there is no list of polyatomic ions on the back. That is because you are expected to know them!

I would also recommend that you buy an AP Chemistry test prep book. There are several available, and they are all good. I recommend 5 Steps to a 5 but Barron's and Princeton Review also provide good review books. If you purchase these books make sure you have a recent copy (no more than 1-2 years old). Read the introduction, and take the diagnostic test in it. This will give you an idea of where you are starting. You could also read and highlight the chapters on the basics and stoichiometry. These books are valuable because they provide many sample questions to get you ready for the exam.

I hope that you will work on this assignment and not put it all off until the last minute. There are many helpful websites where you can find any chemistry information or help you might need. In addition, please feel free to email me at any point if you have questions or concerns, or just need help on a homework problem. My email address is [jonathan.gambrell@cobbk12.org](mailto:jonathan.gambrell@cobbk12.org) I am really looking forward to this class, and I hope you are too!

*Coach Gambrell*

## PERIODIC TABLE OF THE ELEMENTS

1 <b>H</b> 1.008																	2 <b>He</b> 4.00																												
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01															9 <b>F</b> 19.00	10 <b>Ne</b> 20.18																												
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.30															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> 58.69	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.59	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> (98)	44 <b>Ru</b> 101.1	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> 121.75	52 <b>Te</b> 127.60	53 <b>I</b> 126.91	54 <b>Xe</b> 131.29																												
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57 <b>*La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.85	75 <b>Re</b> 186.21	76 <b>Os</b> 190.2	77 <b>Ir</b> 192.2	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> 207.2	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> 226.02	89 <b>†Ac</b> 227.03	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (266)	107 <b>Bh</b> (264)	108 <b>Hs</b> (277)	109 <b>Mt</b> (268)	110 <b>Ds</b> (271)	111 <b>Rg</b> (272)																																			
<p>*Lanthanide Series</p> <table style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>58 <b>Ce</b> 140.12</td> <td>59 <b>Pr</b> 140.91</td> <td>60 <b>Nd</b> 144.24</td> <td>61 <b>Pm</b> (145)</td> <td>62 <b>Sm</b> 150.4</td> <td>63 <b>Eu</b> 151.97</td> <td>64 <b>Gd</b> 157.25</td> <td>65 <b>Tb</b> 158.93</td> <td>66 <b>Dy</b> 162.50</td> <td>67 <b>Ho</b> 164.93</td> <td>68 <b>Er</b> 167.26</td> <td>69 <b>Tm</b> 168.93</td> <td>70 <b>Yb</b> 173.04</td> <td>71 <b>Lu</b> 174.97</td> </tr> </tbody> </table> <p>†Actinide Series</p> <table style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>90 <b>Th</b> 232.04</td> <td>91 <b>Pa</b> 231.04</td> <td>92 <b>U</b> 238.03</td> <td>93 <b>Np</b> (237)</td> <td>94 <b>Pu</b> (244)</td> <td>95 <b>Am</b> (243)</td> <td>96 <b>Cm</b> (247)</td> <td>97 <b>Bk</b> (247)</td> <td>98 <b>Cf</b> (251)</td> <td>99 <b>Es</b> (252)</td> <td>100 <b>Fm</b> (257)</td> <td>101 <b>Md</b> (258)</td> <td>102 <b>No</b> (259)</td> <td>103 <b>Lr</b> (262)</td> </tr> </tbody> </table>																		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> 151.97	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	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	71 <b>Lu</b> 174.97	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> (237)	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (262)
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**AP Chemistry Worksheet 1: Structure of the Atom and the Periodic Table**

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. What were the main points of Dalton's Atomic Theory? Which of these points are still accepted today? Which ones do we no longer accept, and why?
2. Summarize the evidence used by J.J. Thomson to argue that cathode rays consist of negatively charged particles.
3. Let's pretend you are holding two atoms of carbon that are isotopes. Describe what the two atoms have in common and what they have different.
4. Fill in the gaps in the following table, assuming each column represents a neutral atom:

Symbol	$^{39}_{19}\text{K}$				
Protons		25			82
Neutrons		30	64		
Electrons			48	56	
Mass #				137	207

5. Write the correct symbol, with both superscripts and subscripts, for each of the following :
  - (a) the isotope of sodium with mass 23 \_\_\_\_\_
  - (b) the atom of vanadium that contains 28 neutrons \_\_\_\_\_
  - (c) the isotope of chlorine with mass 37 \_\_\_\_\_
  - (d) an atom of magnesium that has an equal number of protons and neutrons \_\_\_\_\_
6. Give the name and the common charge for elements found in each of these groups of the Periodic Table:
  - (a) Group 1
  - (b) Group 2
  - (c) Group 17
  - (d) Group 18
7. Describe where each type of element is found on the Periodic Table.
  - (a) Metals
  - (b) Non-metals
  - (c) Transition metals
  - (d) Lanthanides
  - (e) Actinides

**AP Chemistry Worksheet 2: Naming Inorganic Compounds**

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Give the name for each of the following ionic compounds:

- a.  $\text{AlF}_3$
- b.  $\text{Fe}(\text{OH})_2$
- c.  $\text{Cu}(\text{NO}_3)_2$
- d.  $\text{Ba}(\text{ClO}_4)_2$
- e.  $\text{Li}_3\text{PO}_4$
- f.  $\text{Hg}_2\text{S}$
- g.  $\text{Ca}(\text{CH}_3\text{COO})_2$
- h.  $\text{Cr}_2(\text{CO}_3)_3$
- i.  $\text{K}_2\text{CrO}_4$
- j.  $(\text{NH}_4)_2\text{SO}_4$

2. Write the chemical formula for each of the following compounds:

- a. copper (I) oxide
- b. potassium peroxide
- c. aluminum hydroxide
- d. zinc nitrate
- e. mercury (I) bromide
- f. iron (III) carbonate
- g. sodium hypobromite

3. Give the name or chemical formula, as appropriate, for each of the following acids:

- a.  $\text{HBrO}_3$
- b.  $\text{HBr}$
- c.  $\text{H}_3\text{PO}_4$
- d. hydrochloric acid
- e. iodic acid
- f. sulfurous acid

4. Give the name or chemical formula, as appropriate, for each of the following molecular substances:

- a.  $\text{SF}_6$
- b.  $\text{IF}_5$
- c.  $\text{XeO}_3$
- d. dinitrogen tetroxide
- e. hydrogen cyanide
- f. tetraphosphorous hexasulfide

5. Write the balanced chemical equation for each reaction given below.
- Zinc carbonate can be heated to form zinc oxide and carbon dioxide
  - On treatment with hydrofluoric acid, silicon dioxide forms silicon tetrafluoride and water.
  - Sulfur dioxide reacts with water to form sulfurous acid.
  - Liquid butane fuel ( $C_4H_{10}$ ) burns in the presence of oxygen gas.
  - Perchloric acid reacts with cadmium to form cadmium (II) perchlorate and a gas.
  - A solution of sodium bromide reacts with a solution of vanadium (III) nitrate to form a brightly colored precipitate.

**AP Chemistry Worksheet 3: Atomic and Molecular Masses**

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. What isotope is used as the standard in establishing the atomic mass scale?
  
  
  
  
  
  
  
  
  
  
2. The atomic weight of magnesium is reported as 24.3, yet no atom of magnesium has the mass of 24.3 amu. Explain.
  
  
  
  
  
  
  
  
  
  
3. Only two isotopes of copper occur naturally, Cu-63 (abundance 69.09 percent) and Cu-65 (abundance 30.91 percent). Calculate the average atomic mass of copper.
  
  
  
  
  
  
  
  
  
  
4. Determine the molar mass of each of the following compounds:
  - a.  $\text{N}_2\text{O}_5$
  - b.  $\text{FeCO}_3$
  - c.  $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$
  - d.  $(\text{NH}_4)_3\text{PO}_4$
  - e. sodium nitrate
  - f. copper (II) sulfate
  - g. disilicon hexabromide
  
  
  
  
  
  
  
  
  
  
5. Calculate the percentage by mass of oxygen in the following compounds:
  - a.  $\text{NO}_2$
  
  
  
  
  
  
  
  
  
  
  - b.  $\text{CH}_3\text{COOCH}_3$
  
  
  
  
  
  
  
  
  
  
  - c.  $\text{Cr}(\text{NO}_3)_3$
  
  
  
  
  
  
  
  
  
  
  - d.  $(\text{NH}_4)_2\text{CO}_3$

**AP Chemistry Worksheet 4: *Balancing Equations & Patterns of Reactivity***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Balance the following equations:

- a.  $\text{CO (g)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$
- b.  $\text{N}_2\text{O}_5\text{(g)} + \text{H}_2\text{O (l)} \rightarrow \text{HNO}_3\text{(aq)}$
- c.  $\text{PCl}_5\text{(l)} + \text{H}_2\text{O (l)} \rightarrow \text{H}_3\text{PO}_4\text{(aq)} + \text{HCl (aq)}$
- d.  $\text{CH}_4\text{(g)} + \text{Br}_2\text{(g)} \rightarrow \text{CBr}_4\text{(l)} + \text{HBr (g)}$
- e.  $\text{C}_5\text{H}_{10}\text{O}_2\text{(l)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + \text{H}_2\text{O (l)}$
- f.  $\text{Cr(OH)}_3\text{(s)} + \text{HClO}_4\text{(aq)} \rightarrow \text{Cr(ClO}_4)_3\text{(aq)} + \text{H}_2\text{O (l)}$

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

- a. Solid calcium carbide,  $\text{CaC}_2$ , reacts with water to form an aqueous solution of calcium hydroxide and acetylene gas,  $\text{C}_2\text{H}_2$ .
- b. When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.
- c. Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.
- d. When liquid phosphorous trichloride is added to water, it reacts to form a solution of phosphorous acid and hydrochloric acid.
- e. When hydrogen sulfide gas is passed over solid hot iron (III) hydroxide, the reaction produces solid iron (III) sulfide and gaseous water.

3. a. What products form when a hydrocarbon is completely combusted in air?
- b. Write a balanced chemical equation for the combustion of octane,  $C_8H_{18}(l)$ , in air.
- c. How can you determine the chemical formula of the product formed when the metallic element calcium combines with the nonmetallic element oxygen,  $O_2$ ?
- d. Write the balanced chemical equation for the reaction described in (c).
4. Write a balanced chemical equation for the reaction that occurs when
- a. the hydrocarbon heptane,  $C_7H_{16}(l)$ , is combusted in air
- b. the gasoline additive MTBE (methyl tertiary-butyl ether),  $C_5H_{12}O(l)$ , burns in air
- c.  $Rb(s)$  reacts with water
- d.  $Mg(s)$  reacts with  $Cl_2(g)$
5. Balance the following equations, and indicate what type of reaction each one is:
- a.  $Al(s) + Cl_2(g) \rightarrow AlCl_3(s)$  \_\_\_\_\_
- b.  $C_2H_4(g) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$  \_\_\_\_\_
- c.  $Li(s) + N_2(g) \rightarrow Li_3N(s)$  \_\_\_\_\_
- d.  $PbCO_3(s) \rightarrow PbO(s) + CO_2(g)$  \_\_\_\_\_
- e.  $C_7H_8O_2(l) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$  \_\_\_\_\_

**AP Chemistry Worksheet 5: *The Mole***

*For each problem below, write the equation and show your work. Always use units and box in your final answer.*

1. The molecular formula of aspartame, the artificial sweetener marketed as NutraSweet, is  $C_{14}H_{18}N_2O_5$ .

- a. What is the molar mass of aspartame?
  
  
  
  
  
  
  
  
  
  
- b. How many moles of aspartame are present in 1.00 mg of aspartame?
  
  
  
  
  
  
  
  
  
  
- c. How many molecules of aspartame are present in 1.00 mg of aspartame?
  
  
  
  
  
  
  
  
  
  
- d. How many hydrogen atoms are present in 1.00 mg of aspartame?

2. A sample of glucose,  $C_6H_{12}O_6$ , contains  $2.03 \times 10^{21}$  atoms of carbon.

- a. How many atoms of hydrogen does it contain?
  
  
  
  
  
  
  
  
  
  
- b. How many molecules of glucose does it contain?
  
  
  
  
  
  
  
  
  
  
- c. How many moles of glucose does it contain?
  
  
  
  
  
  
  
  
  
  
- d. What is the mass of the sample in grams?

3. Calculate the following amounts:
- How many moles of chloride ions are in 0.0750 g of magnesium chloride?
  - What is the mass, in grams, of  $3.50 \times 10^{-3}$  mol of aluminum sulfate?
  - What is the mass, in grams, of  $1.75 \times 10^{20}$  molecules of caffeine,  $C_8H_{10}N_4O_2$ ?
  - What is the molar mass of cholesterol if 0.00105 mol weigh 0.406 g?
4. Calculate the number of molecules in:
- 0.0666 mol propane,  $C_3H_8$ , a hydrocarbon fuel
  - A 50.0 mg tablet of acetaminophen,  $C_8H_9O_2N$ , an analgesic solid under the name of Tylenol
  - A tablespoon of table sugar,  $C_{12}H_{22}O_{11}$ , weighing 10.5 g
5. The allowable concentration level of vinyl chloride,  $C_2H_3Cl$ , in the atmosphere in a chemical plant is  $2.0 \times 10^{-6}$  g/L.
- How many moles of vinyl chloride in each liter does this represent?
  - How many molecules per liter is this?



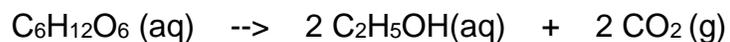
4. Determine the empirical and molecular formulas of each of the following substances:
- Ibuprofen, a headache remedy contains 75.69 percent C, 8.80 percent H, and 15.51 percent O by mass; molar mass about 206 g
  - Benzene contains only carbon and hydrogen and is 7.74% hydrogen by mass. The molar mass of benzene is 78.1 g/mol.
5. Many homes in rural America are heated by propane gas, a compound that contains only carbon and hydrogen. Complete combustion of a sample of propane produced 2.641 g of carbon dioxide and 1.442 g of water as the only products. Find the empirical formula of propane. (Hint: Figure out how many moles of C and H were produced. They all came from the fuel.)
6. (This is probably the hardest problem in the whole packet!) Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of  $\text{CO}_2$  and 0.1159 g of  $\text{H}_2\text{O}$ .
- What is the empirical formula for menthol?
  - If the compound has a molar mass of 156 g/mol, what is its molecular formula?

**AP Chemistry Worksheet 7: Chemical Equations and Calculations**

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Why is it essential to use balanced chemical equations in solving stoichiometry problems?

2. The fermentation of glucose,  $C_6H_{12}O_6$ , produces ethyl alcohol,  $C_2H_5OH$ , and  $CO_2$  as shown here:



a. How many moles of  $CO_2$  are produced when 0.300 mol of  $C_6H_{12}O_6$  reacts in this fashion?

b. How many grams of  $C_6H_{12}O_6$  are needed to form 2.00 g of  $C_2H_5OH$ ?

c. How many molecules of  $CO_2$  form when 2.00 g of  $C_2H_5OH$  are produced?

3. Aluminum sulfide reacts with water to form aluminum hydroxide and hydrogen sulfide.

a. Write the balanced chemical equation for this reaction.

b. How many grams of aluminum hydroxide are obtained from 10.5 g of aluminum sulfide?





3. When hydrogen sulfide gas is bubbled into a solution of sodium hydroxide, the reaction forms sodium sulfide and water. How many grams of sodium sulfide are formed if 2.50 g of hydrogen sulfide is bubbled into a solution containing 1.85 g of sodium hydroxide, assuming that the limiting reagent is completely consumed?
4. Solutions of sulfuric acid and lead (II) acetate react to form solid lead (II) sulfate and a solution of acetic acid. If 10.0 g of sulfuric acid and 10.0 g of lead (II) acetate are mixed, calculate the number of grams of sulfuric acid, lead (II) acetate, lead (II) sulfate, and acetic acid present in the mixture after the reaction is complete.
5. A student reacts benzene,  $C_6H_6$ , with bromine,  $Br_2$ , to prepare bromobenzene,  $C_6H_5Br$ , and  $HBr$ .
- What is the theoretical yield of bromobenzene in this reaction when 30.0 g of benzene reacts with 65.0 g of bromine?
  - If the actual yield of bromobenzene was 56.7 g, what was the percent yield?