2024-2025 AP Chemistry

Congratulations on making the decision to take AP Chemistry! This course will move at a fast pace and cover a substantial amount of material, starting with the first day of school. The primary goal of this course is to earn college credit enrollment by passing the AP Chemistry exam with a score of 3 or 4 or higher in May 2025.

So that we can spend more time on topics new to you in AP Chemistry, you are expected to be familiar answering questions and solving problems using the content covered in your first year chemistry course. The attached **review assignment** covers first-year chemistry topics that will not be taught in AP chemistry. You will have an opportunity to ask questions on this assignment during the first three class periods.

Copies of the periodic table and the metric prefixes you will be using in AP Chemistry are included in this assignment. Please note that this periodic table does not include element names. Charges of monatomic ions and key polyatomic ions that need to be memorized by the first test are also included. You are encouraged to make flashcards card deck to begin learning these ions.

I wish each of you a restful and enjoyable summer, and I look forward to seeing you next school year!

Mrs. Amin

AP Chemistry Ions

Monatomic Cations	**Monatomic Anions**	**Polyatomic Cations**	**Polyatomic Anions**
Group 1 (including H) H^{+1}, hydrogen Li^{+1}, lithium Na^{+1}, sodium K^{+1}, potassium Cs^{+1}, cesium Group 2 Be^{+2}, beryllium Mg^{+2}, magnesium Ca^{+2}, calcium Sr^{+2}, strontium Ba^{+2}, barium Group 13 Al^{+3}, aluminum Transition and Heavier Metals Cr^{+2}, chromium (II) Cr^{+3}, chromium (III) Mn^{+2}, manganese (II) Mn^{+4}, manganese (IV) Mn^{+7}, manganese (VII) Cu^{+1}, copper (I) Cu^{+2}, copper (II) Fe^{+2}, iron (II) Fe^{+3}, iron (III) Pb^{+2}, lead (II) Pb^{+4}, lead (IV) Hg^{+2}, mercury (II) Ni^{+2}, nickel (II) Ni^{+3}, nickel (III) Sn^{+2}, tin (II) Sn^{+4}, tin (IV) Ag^{+1}, silver Zn^{+2}, zinc	Group 17 and H H^{-1}, hydride F^{-1}, fluoride Cl^{-1}, chloride Br^{-1}, bromide I^{-1}, iodide Group 16 O^{-2}, oxide S^{-2}, sulfide Group 15 N^{-3}, nitride P^{-3}, phosphide	Ammonium, NH_4^{+1} Mercury (I), Hg_2^{+2}	Acetate, $C_2H_3O_2^{-1}$ Bicarbonate (hydrogen carbonate), HCO_3^{-1} Carbonate, CO_3^{-2} Perchlorate, ClO_4^{-1} Chlorate, ClO_3^{-1} Chlorite, ClO_2^{-1} Hypochlorite, ClO^{-1} Permanganate, MnO_4^{-1} Cyanide, CN^{-1} Hydroxide, OH^{-1} Peroxide, O_2^{-2} Nitrate, NO_3^{-1} Nitrite, NO_2^{-1} Chromate, CrO_4^{-2} Dichromate, $Cr_2O_7^{-2}$ Sulfate, SO_4^{-2} Sulfite, SO_3^{-2} Phosphate, PO_4^{-3} Phosphite, PO_3^{-3}

***Note: Transition metals are named with Roman numerals to indicate their oxidation state (charge) if they have multiple oxidation states. Silver and zinc are the only transition metals on this list that have a single oxidation state and therefore are not named with roman numerals. As long as you know which transition metals need Roman numerals, individual charges of these metals do not need to be memorized.

INFORMATION IN THE TABLE BELOW AND IN THE TABLES ON PAGES 3-5 MAY BE USEFUL IN ANSWERING THE QUESTIONS IN THIS SECTION OF THE EXAMINATION.

DO NOT DETACH FROM BOOK.

PERIODIC TABLE OF THE ELEMENTS

1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 16.00	9 F 19.00	10 Ne 20.179
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.938	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 § (269)	111 § (272)	112 § (277)						

§Not yet named

*Lanthanide Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
†Actinide Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

GO ON TO THE NEXT PAGE.

Metric Conversions

Unit	Symbol	*Equivalent Expressions*	
mega	M	**1 Mg** = 1,000,000 g = 10^6 g	**1 Mg** = 1,000,000 g = 10^6 g
kilo	k	**1 kg** = 1,000 g = 10^3 g	**1 kg** = 1,000 g = 10^3 g
hecta	h	**1 hg** = 100 g = 10^2 g	**1 hg** = 100 g = 10^2 g
deca	da	**1 dag** = 10 g = 10^1 g	**1 dag** = 10 g = 10^1 g
o		1g = 10^0g	1g = 10^0g
deci	d	**1 g** = 10 dg = 10^1 dg	**1 dg** = 0.1 g = 10^{-1} g
centi	c	**1 g** = 100 cg = 10^2 cg	**1 cg** = 0.01 g = 10^{-2} g
milli	m	**1 g** = 1,000 mg = 10^3 mg	**1 mg** = 0.001 g = 10^{-3} g
micro	µ	**1 g** = 1,000,000 µg = 10^6 µg	**1 µg** = 0.000001 g = 10^{-6} g
nano	n	**1 g** = 1,000,000,000 ng = 10^9 ng	**1 ng** = 0.000000001 g = 10^{-9} g
pico	p	**1 g** = 1,000,000,000,000 pg = 10^{12} pg	**1 pg** = 0.000000000001 g = 10^{-12} g

* Any quantity can be substituted for g; ie. 1 L = 1000 mL just as 1 g = 1000 mg

A helpful pnemonic for memorizing prefixes (you need to know these):

Many kids have dropped over dead converting metric measurements in problems.

Advanced Placement Chemistry Review Assignment

Topic 1: Significant Figures & Scientific Notation

1. Count the number of significant figures in the following measurements.

   a. 2.71 g _____ b. 0.00047 kg _____ c. 7.0×10^5 m _____ d. 1,030 L _____

   e. 150 pencils _____ f. 37500 µg _____ g. 0.1010 cm _____

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 ng _____ d. 481.9×10^{-9} cm _____

3. Calculate the correct answer with proper units and significant figures for each of the following:

   a. 12 g + 0.677 g + 86.33 g = _____

   b. (355.78 g) / (0.056 g) = _____

   c. 97.34 mL – 34.1 mL = _____

   d. 14.68 x 5 = _____

Topic 2: Dimensional Analysis

Show work using dimensional analysis. No work = no credit even if answer is correct. Follow significant figures and rounding rules unless the number of significant figures is specified. Include units where appropriate.

4. How many hours are in a week? Report your answer to three significant figures.

5. Find the number of centimeters in 1.00×10^2 yards. (1 yd = 3 ft, 1 ft = 12 in, 2.54 cm = 1 in)

6. Wavelengths are often represented in nm. What is the diameter of a helium (He) atom in nm if it is equivalent to 1.0×10^{-13} km?

Topic 3: Density and Temperature

Show all work. No work = no credit even if answer is correct. Follow significant figures and rounding rules. Include units where appropriate.

7. 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 are the volume and the density of the block?

8. 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?

Topic 4: Precision and Accuracy

9. The density of ethanol was determined experimentally at 25°C in a series of trials to be 0.608 g/mL, 0.705 g/mL, and 0.689 g/mL. The accepted density of ethanol is reported to be 0.789 g/mL.
   a. Are the experimental densities precise? Why/Why not?

   b. Calculate % error for this experiment. Use the average experimental density in your calculation and report your answer to 0.1%. Show your work

Topic 5: Properties and Changes

10. Categorize each of the following as an element, a compound, or a mixture:
    a. carbonated water _____
    b. tungsten _____
    c. aspirin (acetylsalicylic acid) _____
    d. air _____
    e. lye (sodium hydroxide) _____
    f. fluorine _____

11. 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. Iron rusts on a car. _____
    h. Alkali metals react strongly in hydrochloric acid. _____

Topic 6: Atom Structure & History

12. How many protons and neutrons are contained in the nucleus of each of the following atoms? How many electrons are present in each of these neutral atoms?
    a. ${}^{13}_{6}C$ ____ protons ____ neutrons ____ electrons

b. $^{208}_{82}Pb$ ____ protons ____ neutrons ____ electrons

13. Complete the following table:

Name	Mass #	Atomic #	# of Protons	# of Neutrons	# of Electrons	Symbol
Gallium-70					31	
						$^{31}_{15}P^{-3}$
Strontium-80					36	
						$^{55}_{25}Mn^{+2}$

14. The natural abundance for boron isotopes is 19.9% boron-10 (exact mass 10.013 amu) and 80.1% boron-11 (exact mass 11.009 amu). Calculate the average atomic mass of boron using the exact masses instead of mass numbers in your calculations. Show your work. Follow significant figures and rounding rules. Include appropriate units.

15. Europium has two stable isotopes, ^{151}Eu and ^{153}Eu, with masses of 150.9197 u and 152.9212 u, respectively. Calculate the percent abundances of these isotopes of europium to 0.1%. Hint: The percent abundances of these two isotopes must add to 100%. Show your work. Follow significant figures and rounding rules. Include appropriate units.

16. Identify the scientist(s) noted for the following events in atomic history.
    a. identified the electron; noted for the plum pudding model _____
    b. noted for the first atomic theory of the atom; solid sphere model _____
    c. developed the planetary model; electrons in fixed orbits _____
    d. developed the quantum mechanical model; electrons are localized to orbitals _____
    e. identified the proton and the nucleus; nuclear model _____
    f. determined the charge of an electron _____
    g. described wave theory _____
    h. known for the uncertainty principle _____
    i. developed quantum numbers _____

25. Identify the model of the atom described in the following statements.
    a. currently accepted model _____
    b. model that first included a subatomic particle _____
    c. model developed using the gold foil experiment _____
    d. original model of the atom; atom was thought to be “indivisible” _____
    e. model that only showed the movement of hydrogen’s electron accurately; involved “quantums” _____

Topic 7: Periodic Table Structure

Identify by name the group or section of the periodic table noted for the following features.

26. a. group containing the most reactive nonmetals; all are diatomics; form -1 ions _____

    b. group containing metals that only form +2 ions _____

    c. set of metals that often form colored ions in solution; the majority have multiple charges as ions

    _____

    d. group containing the most reactive metals; form +1 ions _____

    e. group containing least reactive elements on periodic table, typically inert _____

27. These elements start with the letter B: B, Ba, Bk, Bi, and Br. Identify which of these elements match the following descriptions. You may use elements once, more than once, or not at all.
    a. Which are metals? _____
    b. Which are liquids? _____
    c. Which are actinides? _____
    d. Which are main block elements? _____

Topic 8: Compound Nomenclature

28. Name or give the formula for the following compounds. All ions included in the summer letter are required to be memorized by name and by formula.

	Name	Formula
a.	lithium fluoride	_____
b.	_____	K_2O
c.	calcium phosphate	_____
d.	_____	$MnCl_2$
e.	silver sulfide	_____
f.	_____	Cu_2O
g.	aluminum sulfate	_____
h.	_____	$ZnCO_3$
i.	chromium (III) phosphide	_____
j.	_____	SO_3
k.	lead (IV) hydroxide	_____
l.	_____	N_2O_5
m.	ammonium sulfite	_____
n.	_____	$BaCr_2O_7$
o.	sodium peroxide	_____
p.	_____	NH_3 (use common names; see ppt/videos if necessary)
q.	nickel (II) hypochlorite	_____
r.	_____	$Fe(CN)_3$
s.	rubidium chromate	_____
t.	_____	$Mg_3(PO_4)_2$

Topic 9: Equations

29. Balance the following equations using the lowest whole-number coefficients.

a. __Fe + __P_4 → __Fe_3P_2

b. __Ca + __H_2O → __$Ca(OH)_2$ + __H_2

c. __$Ba(OH)_2$ + __H_3PO_4 → __$Ba_3(PO_4)_2$ + __H_2O

d. __$(NH_4)_2CO_3$ + __$Al(ClO_3)_3$ → __$Al_2(CO_3)_3$ + __NH_4ClO_3

[-342222222222222444430. Write balanced chemical equations for the following word equations. Use the lowest possible whole-number coefficients to balance the equations.

a. Aqueous solutions of ammonium sulfate and barium nitrate form a precipitate of barium sulfate and aqueous ammonium nitrate.

b. Elemental magnesium and oxygen gas combine to form solid magnesium oxide.

c. Chlorine gas and aqueous potassium bromide react to form bromine liquid and aqueous potassium chloride.

Topic 10: Mole Conversions & Stoichiometry

Show your work. No work = no credit. Follow significant figures and rounding rules. Include appropriate units.

31. a. Calculate the number of moles in 500. atoms of iron (Fe).

b. What is the molar mass of lead (IV) carbonate, $Pb(CO_3)_2$?

c. How many formula units are present in 87.2 grams of lead (IV) carbonate?

d. What percentage of oxygen is found in lead (IV) carbonate? Round your answer to 0.1%.

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

__Al(s) + __ NH_4ClO_4(s) → __ Al_2O_3(s) + __ $AlCl_3$(s) + _ NO(g) + __H_2O(g)

a. Balance the above reaction using the lowest possible whole-number coefficients.

b. If 4.00 g of aluminum reacted completely, how many grams of aluminum oxide would be made?

c. If 4.18 g of aluminum chloride was produced, how many moles of ammonium perchlorate would be consumed?

d. How many molecules of nitrogen monoxide would form if $6.3x10^{25}$ formula units of aluminum oxide were also produced?

33. The decomposition of ammonia is shown in the following equation: $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$.

a. 42.0 g of nitrogen has what volume in liters at STP?

b. 150 L of NH_3 undergoes decomposition to form how many liters of hydrogen gas at STP?

c. How many liters of ammonia were decomposed at STP if $3.0x10^{23}$ nitrogen molecules were made?