

AP Chemistry
Summer Packet
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Welcome to AP Chemistry! This course is designed to give you a more complete experience of chemistry that will prepare you for both the AP Chem exam in the spring of next year and for introductory chemistry in college.

The only way to complete all the topics in this course is to move at a very rapid pace. Therefore, it is critical for all students to complete the summer assignment to be ready to get after it in the fall.

Course Overview:

The course is taught through a series of lectures and laboratories with homework problems, practice exams, and individual projects. Chapter exams, laboratories and homework assignments comprise the bulk of the grading criteria. Homework is expected to be accomplished within one or two days after assignment. Keeping

Tips for achieving success in AP Chemistry:

- Study AP Chem every day and make sure that study time is productive (ask me if you don't know how to make your time productive...). If there are no formal assignments, you should be using study time to review your class notes, give yourself a practice quiz, etc.
- Choose a study partner that you can also use as a lab partner. **This class is very difficult if done alone.** Pairs are better than larger groups. Get together at regularly scheduled times for study and homework. Avoid "splitting up" the work.
- Avoid getting behind in this course. If you get stuck on a concept or HW set, get help immediately via ParentSquare, Remind, E-mail, or Schoology.
- Attend study sessions regularly. Tutoring hours are held every morning from 7:15-7:40. Clear this time right away with your coach, boss, or parent. During this time we are able to go over H/W problems, old exam questions, etc.

The Commitment:

If you taking this course, you have already enjoyed success in your academic career. Taking a course such as AP Chem will be very different than courses you have taken in the past. It will involve a level of work and commitment that you may not have experienced before. Below is list of realities that you must face:

- Straight-A students often get their first B in AP Chem and other students receive their first C. An A in this course will take tremendous effort.
- Missing class for sports, vacations, activities, etc, will result in falling behind and extreme difficulty in getting caught up. In this course multiple missed days will be very hard to make up.
- You must accept the fact that you will have significant work outside of class and may need to get help on assignments and lab work.

We are going to have an exciting, challenging, and fun year. I look forward to working with you all next year. I hope you have a great summer. If you do have any questions please feel free to email me this summer.

AP CHEM SUMMER ASSIGNMENT

Before you arrive on the first day of class, you will need to have memorized or learned the following items or concepts. **You will be responsible for everything on the pages to follow.**

Make sure you memorize the following items. Know name, formula (or symbol) and charges:

Common Polyatomic Ions

-1	-2	-3
acetate CH_3COO^- chlorate ClO_3^- chlorite ClO_2^- cyanide CN^- dihydrogen phosphate H_2PO_4^- hydrogen carbonate HCO_3^- (bicarbonate) hydrogen sulfate HSO_4^- (bisulfate) hydrogen sulfide HS^- (bisulfide) hydrogen sulfite HSO_3^- (bisulfite) hydroxide OH^- hypochlorite OCl^- iodate IO_3^- nitrate NO_3^- perchlorate ClO_4^- permanganate MnO_4^- thiocyanate SCN^-	carbonate CO_3^{2-} chromate CrO_4^{2-} dichromate $\text{Cr}_2\text{O}_7^{2-}$ hydrogen phosphate HPO_4^{2-} oxalate $\text{C}_2\text{O}_4^{2-}$ peroxide O_2^{2-} silicate SiO_3^{2-} sulfate SO_4^{2-} sulfite SO_3^{2-} thiosulfate $\text{S}_2\text{O}_3^{2-}$	phosphate PO_4^{3-} phosphite PO_3^{3-}

*Ammonium NH_4^+

THE SOLUBILITY RULES

- *1. The nitrates, nitrites, chlorates, and acetates of all metals are soluble in water.
- *2. All Group I and ammonium salts are soluble in water.
- *3. The chlorides, bromides, and iodides of all metals except lead, silver, and mercury (I) are soluble in water.
4. The sulfates of all metals except lead, strontium, mercury (I), and barium are soluble in water.
5. The carbonates, phosphates, borates, sulfites, chromates, and arsenates of all metals except sodium, potassium, and ammonium are insoluble in water.
6. The sulfides of all metals except lithium, barium, calcium, magnesium, potassium, sodium, and ammonium are insoluble in water.
7. The hydroxides of lithium, sodium, potassium, and ammonium are very soluble in water.

*These rules in particular are the most common. Focus on these first.

Naming Review

If given the name, write the formula and visa versa. I must be able to read your work or I will not grade it.

Make sure you have correct sizing of your letters.

1. AlCl_3	26. Magnesium silicate
2. C_2H_6	27. Carbon monoxide
3. $\text{Cu}(\text{NO}_3)_2$	28. Sulfurous acid
4. SI_6	29. silicon disulfide
5. CF_4	30. Iron (III) oxide
6. HClO_4	31. Potassium iodate
7. C_8H_{18}	32. Sodium thiocyanate
8. K_3N	33. Zinc (II) nitrate
9. HF	34. Barium phosphite
10. BBr_3	35. Diphosphorus pentoxide
11. NH_4F	36. Phosphoric acid
12. $\text{Sn}(\text{CN})_4$	37. Butane
13. $\text{Mg}(\text{OH})_2$	38. Sodium thiosulfate
14. NaI	39. Potassium permanganate
15. H_2SO_4	40. Hydrobromic acid
16. PbCO_3	41. Selenium hexaiodide
17. NH_4NO_3	42. Silver (I) nitrate
18. NaOH	43. Ammonium dichromate
19. HCl	44. Dinitrogen tetroxide
20. HNO_3	45. Hydrosulfuric acid
21. CuO	46. Arsenic pentafluoride
22. Cu_2O	47. Xenon difluoride
23. H_2O_2	48. Propane
24. $\text{Ca}(\text{HSO}_4)_2$	49. Tin (IV) hypoiodite
25. Ag_2S	50. Nitrous acid

Unit 1 Review: Units in Measurement

1.) Use prefixes to express each measurement without any exponents and to the proper number of significant figures. (Ex. $5.3 \times 10^{-3} \text{ m}$ → 5.3 mm)

a. $1.2 \times 10^{-9} \text{ m}$ _____

d. $55.2 \times 10^{-4} \text{ s}$ _____

b. $1.5 \times 10^3 \text{ g}$ _____

e. $2.70 \times 10^{-2} \text{ mol}$ _____

c. $3.24 \times 10^{-6} \text{ L}$ _____

2.) Use scientific notation to express each quantity with only the base units (no prefixes).

Example: 5,340 ms = 5.34 s.

a. 4.5 ns _____

d. 35 μm _____

b. 18 cm _____

e. 710. kg _____

c. 128 pm _____

3.) Complete the table.

a. 1245 kg	_____ g	_____ mg
b. 515 km	_____ dm	_____ cm
c. 122 s	_____ ms	_____ ks
d. 3.35 J	_____ kJ	_____ mJ

Significant Figures

Give the number of significant figures in each of the following:

1.) 402 m _____

6.) 0.0300 ft. _____

2.) 34.20 lbs _____

7.) $5.1 \times 10^4 \text{ kg}$ _____

3.) 0.03 sec _____

8.) 0.48 m _____

4.) 0.00420 g _____

9.) 1,400.0 m _____

5.) 3,200 liters _____

10.) 78,323.01 g _____

Carry out the following calculations and round your answer to the proper number of significant figures (no work needs to be shown, just your answer).

1. $9.15 \text{ m} \div 4.970 \text{ m} =$ _____

2. $1.54 \text{ m} + 0.03060 \text{ m} + 0.69 \text{ m} =$ _____

3. $27.5 \text{ m} \times 1.82 \text{ m} \div 100.04 \text{ m} =$ _____

4. $(2.290 \times 10^6 \text{ m}) \div (6.7 \times 10^4 \text{ m}) =$ _____

5. $43.7 \text{ m} - 2.341 \text{ m} =$ _____

Unit 2 Review: Classifying Matter

1. Classify each substance as a pure substance (PM) or mixture (M). If pure substance, classify as an element (E) or compound (C). If mixture, classify as heterogeneous (HT) or homogeneous (HO).

a. sweet tea _____
b. aluminum _____
c. carbon dioxide _____
d. vegetable soup _____
e. iron _____

f. fruit salad _____
g. magnesium oxide _____
h. apple juice _____
i. hydrogen peroxide _____

2. Classify each of the properties of isopropyl alcohol as physical (P) or chemical (C)

a. colorless _____
b. flammable _____
c. liquid at room temperature _____
d. density = 0.79 g/mL _____
e. mixes with water _____

3. Classify the following as a physical (P) or chemical (C) change.

a. Liquid propane evaporates _____
b. Liquid propane burns _____
c. Iron rusts _____
d. Sugar dissolves in water _____
e. Platinum becomes dull from abrasion _____

Unit 3 Review:

Atomic Structure

Name	Symbol	Atomic #	Mass #	Neutrons	Protons	Electrons
Titanium				26		
	C		12			
Lithium-7						

2. Determine the average mass of an element based on data table the isotopic abundance and the mass of each isotope of Neon. Round your answer to two decimal places.

Isotope	% Abundance
²⁰ Ne	90.48
²¹ Ne	0.27
²² Ne	9.25

Unit 4 Review:

Write the electron configurations for each of the following using the notation specified:

Full Configuration

1. Na _____
2. O^{2-} _____
3. Ta _____
4. Al^{3+} _____
5. Ni _____

Noble Gas Notation

1. Zn _____
2. Si _____
3. K^+ _____
4. Sn^{2+} _____
5. Bi _____

Orbital Notation

- | | |
|-------------|--------------|
| 1. S^{2-} | 3. Zn^{2+} |
| 2. Ga | 4. Fe^{2+} |

Wavelength, Frequency, and Energy

For each of the following, show all work to receive credit. Every value must have a unit. Round answer to proper sig figs.

1. Calculate the frequency of a wave with a wavelength of 436 nm.
2. Calculate the energy of a wave with a frequency of $6.14 \times 10^{14} \text{ s}^{-1}$.
3. Calculate the energy of a wave with a wavelength of 685 nm.

Unit 5 Review: Periodic Trends

For each of the following, answer in the form of claim, evidence, reasoning (CER). Your reasoning should relate Coulomb's law to your evidence.

Example of CER: Which atom is larger, Ne or Ar? Claim: Argon is larger. Evidence: Argon has one more principal energy level occupied than neon. Reasoning: The more occupied energy levels, the farther away from the nucleus the valence electrons are, creating a larger atom.

1. Which would have the higher first ionization energy, Na or P? Justify your answer.

2. Which would have the smaller radius, S or S^{2-} ? Justify your answer.

3. Which would have the lower electron affinity, O or Se? Justify your answer.

4. Which would have the larger radius, Mg or Mg^{2+} ? Justify your answer.

5. Which would have the higher ionization energy, F or Br? Justify your answer.

Unit 6: Ionic Bonding Review

Explain the following observations about ionic compounds using Coulomb's Law and CER format.

1. MgO has a melting point of $2,852^{\circ}\text{C}$ while NaF has a melting point of 993°C .

2. NaF has a melting point of 993°C while NaBr has a melting point of 737°C .

3. Which of the following would have the higher lattice energy, Al_2O_3 or Na_2O ?

Draw the Lewis Dot Diagram for the following compounds. Remember to use brackets and charges on ions.

4. LiF

5. BeO

6. CaF_2

Unit 7: Covalent Bonding Review

Draw the Lewis Structure (3D if possible) for each of the following. If polar, label the partial positive and partial negative regions on the molecule. If nonpolar, write nonpolar in the space provided by the formula. Then state the information requested on the lines provided. State the central atom's hybridization only.

1) CH_2O Geometry: _____ Bond Angle: _____ Polarity: _____ Hybridization: _____	2) CH_2Cl_2 Geometry: _____ Bond Angles: _____ Polarity: _____ Hybridization: _____
3) OF_2 Geometry: _____ Bond Angles: _____ Polarity: _____ Hybridization: _____	4) HCN Geometry: _____ Bond Angles: _____ Polarity: _____ Hybridization: _____

For each of the following, answer in complete sentences.

5. Which would have the longest bond, Si-F or C-F? Explain your answer.

6. Which would have the stronger bond, N₂ or F₂? Explain your answer.

7. Which would have the stronger bond, F₂ or Br₂? Explain your answer.

Unit 8: IMF Review

State the polarity (polar or nonpolar) and the dominant intermolecular force that is observed in the following molecules:

1. CH₂F₂
Polarity: _____
IMF: _____

3. NF₃
Polarity: _____
IMF: _____

2. CH₃OH
Polarity: _____
IMF: _____

4. BF₃
Polarity: _____
IMF: _____

Explain the following observations. Your explanation should include the intermolecular forces of both substances.

5. Even though NH₃ and CH₄ have similar molar masses, NH₃ has a much higher boiling point (-33°C) than CH₄ (-164°C).

6. At standard temperature (0°C) and pressure (1.00 atm), ethane (C₂H₆) is a gas whereas hexane (C₆H₁₄) is a liquid.

Indicate whether you agree with the statement below or not. Support your answer with a short explanation:

Statement: When water boils, H₂O molecules break apart to form hydrogen and oxygen molecules.

Unit 9: Chemical Reactions Review

Predict the products, state the reaction type (synthesis, single displacement, double displacement, combustion, decomposition), and balance the reaction for each of the following:

Balanced Reaction	Reaction Type
1.) ____ Na + ____ CuBr ₃ →	
2.) ____ NaOH + ____ HCl →	
3.) ____ C ₂ H ₆ + ____ O ₂ →	
4.) ____ CaCO ₃ → ____ CaO + CO ₂	
5.) ____ MgCl ₂ + ____ AgNO ₃ →	
6.) ____ C ₆ H ₁₄ + ____ O ₂ →	
7.) ____ HCl + ____ Al →	
8.) ____ NaOH + ____ NiCl ₂ →	
9.) ____ NaBr + ____ Cl ₂ →	
10.) ____ Mg + ____ O ₂ →	

For the following reactions, write the balanced, complete ionic, and net ionic equations. Remember to include charges, coefficients, and physical states where applicable.

11.) Solutions of sodium sulfate and calcium chloride react to form a calcium sulfate precipitate and sodium chloride ions

Balanced: _____

Complete ionic: _____

Net Ionic: _____

12.) Solutions of hydrochloric acid and potassium hydroxide react to form water in a solution of potassium chloride. (Water is NOT aqueous...)

Balanced: _____

Complete ionic: _____

Net Ionic: _____

Unit 10: Analytical Chemistry Review

For each of the following, you must solve the problem using dimensional analysis (cancellation of units). All values must have a unit and substance label. Round your answer to the proper number of significant figures.

1. How many atoms are in 5.43 g of sodium?
2. How many hydroxide ions are present in 17.1 mol of magnesium hydroxide?
3. What mass of iron can be isolated from 0.765 g of iron (III) oxide?
4. How many moles of potassium chlorate are in 9.12 kg?
5. How many chloride ions are in 3.200 mg of strontium chloride?
6. Glycerol is a thick, sweet liquid obtained as a byproduct of the manufacture of soap. Its percent composition is 39.12% carbon, 8.75% hydrogen, and 52.12% oxygen. The molecular mass is 92.11 g/mol. What are the empirical and molecular formulas for glycerol?
7. A 15.67 g sample of a hydrate of magnesium carbonate was heated to drive off the water. The mass was reduced to 7.58 g. What is the formula of the hydrate?

Unit 11: Stoichiometry Review

1. Ammonia reacts with oxygen to produce nitrogen monoxide and water. Write the balanced equation below:

- a. What mass of water will be produced when 100.0 g of ammonia is reacted with excess oxygen?
- b. If the reaction is done with 25.0 g of each reactant, what mass of nitrogen monoxide can be collected?

2. Sodium sulfide reacts with silver (I) nitrate. Predict the products and balance the reaction.

- a. If the reaction is carried out with 50.0 g of sodium sulfide and 35.0 g of silver nitrate, which is the limiting reactant?
- b. What mass of the excess reactant remains?
- c. What mass of silver (I) sulfide would precipitate?
- d. What is the percent yield if only 5.76 g of silver (I) sulfide is collected?