

AP Chemistry Summer Assignment Instructions

To: AP Chemistry Students and families

Re: AP Chemistry Summer Assignment

Welcome to AP Chemistry! AP chemistry covers a lot of concepts at a fast pace. We need to get started right away and not waste time going over things you already know. This assignment is meant to be mostly a review with a few topics that may be new to you (significant figures & empirical formula). If you have some questions while you are doing the summer assignment, you will have a chance to ask in the first days of the school year.

The assignment is due the first week of class and will constitute your first homework grade. If you have any questions or trouble completing any of the problems, don't hesitate to email me

Most sections have videos to refresh the topics and go over explanations. If you're stuck or don't remember, please make use of the videos to refresh your memory and/or learn the concept.

On the first day, we will cover the syllabus and pertinent information for class as well as get started with AP Chemistry content (continuing into day 2). On day three, you will have a quiz on all the concepts covered in the summer assignment.

If you would like to purchase a prep book, I recommend the AP Chemistry Premium Prep book by Barrons or Princeton Review. It is not a requirement to purchase the book as you will have access to AP Classroom and Khan Academy for instructional materials and practice.

Looking forward to a great year with you!
Have a wonderful summer!

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- Write the numbers represented by the following prefixes:
 - mega
 - kilo
 - deci
 - centi
 - milli
 - micro
 - nano
 - pico
- Convert the following temperatures to Kelvin:
 - 113°C, the melting point of sulfur
 - 37°C, the normal body temperature
 - 357°C, the boiling point of mercury
- Convert the following temperature to degrees Celsius:
 - 77 K, the boiling point of liquid nitrogen
 - 4.2 K, the boiling point of liquid helium
 - 601 K, the melting point of lead

Significant Figures Video: <https://www.youtube.com/watch?v=l2yuDvwYq5g>

this topic is likely new to you

- What is the number of significant figures in each of the following measurements?
 - 48670 mi
 - 506 mL
 - 60,104 ton
 - 2900 g
 - 40.2 g/cm³
 - 0.0250 L
 200. m
 - 0.0003 cm
 - 120.0 kL
- Carry out the following calculations as if they were calculations of experimental results, and express each answer in the correct units with the correct number of significant figures.
 - 5.6792 m + 0.6 m + 4.33 m
 - 3.70 g - 2.9133 g
 - 4.51 cm x 3.6666 cm

Dimensional Analysis Refresh Video: <https://www.youtube.com/watch?v=7N0IRJLwpPI>

- Carry out the following conversions (you must use dimensional analysis):
 - 22.6 m to dm
 - 25.4 mg to kg
 - 556 mL to L

d. 10.6 kg/m^3 to g/cm^3

7. Bromine is a reddish-brown liquid. Calculate the density of bromine (in g/mL) if 0.586kg of the substance occupies 188 mL .

8. The average speed of helium at 25°C is 1255 m/s . Convert this speed to miles per hour (mph) using conversion factors.

9. Indicate the number of protons, neutrons, and electrons in each of the following species:

a. Nitrogen-15

d. Strontium-84

b. Sulfur-33

e. Barium-130

c. Copper-63

f. Tungsten-185

g. Mercury-202

Electron Configuration Refresh - <https://www.youtube.com/watch?v=zUT3Ubk2JOM>

10. Write the complete electron configuration for the following elements:

a. Sulfur

d. Magnesium

b. Aluminum

e. Barium

c. Bromine

f. Vanadium

g. Tungsten

11. Write the formula of the common ion derived from each of the following:

a. Li

e. Al

b. S

f. Cs

c. I

g. Mg

d. N

h. O

Ionic Compound Chemical Formulas Refresh - <https://www.youtube.com/watch?v=URc75hoKGLY>

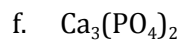
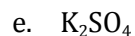
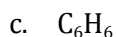
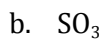
12. Fill in the blanks in the following table:

Cation	Anion	Formula	Name
			Magnesium bicarbonate
		SrCl ₂	
Fe ³⁺	NO ₂ ⁻		
			Manganese (II) chlorate
		SnBr ₄	
Co ²⁺	PO ₄ ³⁻		
Hg ²⁺	I ⁻		
		Cu ₂ CO ₃	
			Lithium nitride
Al ³⁺	S ²⁻		

Mole Conversion Refresh Videos -

- [Molar Mass Video click here](#)
- [Moles to atoms click here](#)
- [Molarity click here](#)

13. Calculate the molar mass of each of the following substances:



14. What is the molarity of 0.0500 moles of NaCl in a 250.0 mL solution?

15. What is the molarity when 25.0 g of MgF₂ is dissolved into a 100.0 mL solution?16. How many moles of cobalt (Co) atoms are there in 6.00 x 10⁹ cobalt atoms?

17. How many moles of calcium (Ca) atoms are in 77.4 g of calcium?

18. How many atoms are present in 3.14 g of copper (Cu)?

19. How many molecules of ethane (C₂H₆) are present in 0.334 g?

Empirical Formula Video: <https://www.youtube.com/watch?v=JeSSucG-CVw>

this topic is likely new to you

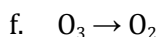
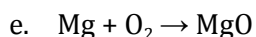
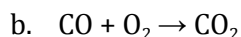
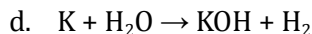
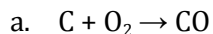
20. What are the empirical formulas of the compounds with the following compositions?

a. 40.1% C, 6.6% H, 53.3% O

b. 18.4% C, 21.5% N, 60.1% K

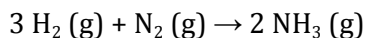
21. The empirical formula of a compound is CH. If the molar mass of this compound is about 78 g, what is the molecular formula?

22. Balance the following equations:



Stoichiometry Refresh Slides -  Stoichiometry Refresh

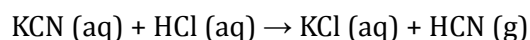
23. Ammonia is a principal nitrogen fertilizer. It is prepared by the reaction between nitrogen and hydrogen.



In a particular reaction, 6.0 moles of NH₃ were produced. How many moles of H₂ and how many moles of N₂ were reacted to produce this amount of NH₃?

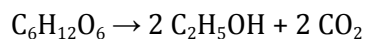
24. When baking soda (sodium bicarbonate or sodium hydrogen carbonate, NaHCO_3) is heated, it releases water, sodium carbonate, and carbon dioxide gas, which is responsible for the rising of dough in cookies, rolls, and donuts.
- Write the balanced equation for the decomposition of the compound.
 - Calculate the mass of NaHCO_3 required to produce 20.5 g of CO_2 .

25. When potassium cyanide reacts with acids, a deadly poisonous gas, hydrocyanic acid is produced. Here is the equation:



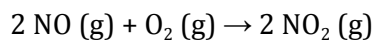
If a sample of 0.140 g of KCN is treated with excess HCl, calculate the amount of HCN formed, in grams.

26. Fermentation is a complex chemical process of wine making in which glucose is converted into ethanol and carbon dioxide:



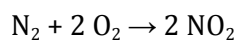
Starting with 500.4 g of glucose, what is the maximum amount of ethanol in grams and in liters that can be obtained by the process? (Density of ethanol is 0.789 g/mL)

27. Nitrogen monoxide reacts with oxygen to form nitrogen dioxide, a dark brown gas.



In one experiment, 0.886 mole of NO is mixed with 0.503 mole of O₂. Calculate which of these two reactants is the limiting reactant. Also calculate the number of moles of NO₂ produced.

28. Nitrogen and oxygen combine in the following reaction:



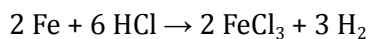
If 2.5 moles of nitrogen reacts with 4.5 moles of oxygen:

a. How many moles of NO₂ are produced?

b. What is the limiting reagent of this problem?

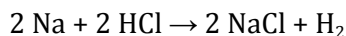
c. How many moles of the excess reagent remain after the reaction is complete?

29. Iron reacts with hydrochloric acid according to the following:



If 10.0 grams of iron reacts with 20.0 g of HCl, what volume of hydrogen is produced at STP? (Remember: STP = Standard Temperature and Pressure, 0 °C and 1 atm. At STP, 1.00 mole of any gas occupies 22.4 L.) What is the limiting reagent, how many moles of the excess reagent remain after the reaction is complete?

30. When 3.5×10^{23} atoms of Na is added to 250.0 mL of 3.00 M HCl, what mass of sodium chloride is produced?



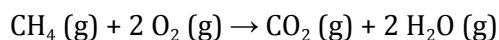
Relationships between Gas Variables Refresh - <https://www.youtube.com/watch?v=WhP6zJbSxec>

Using the Ideal Gas Law Refresh - <https://www.youtube.com/watch?v=TqLlfHBFY08>

31. A sample of nitrogen gas kept in a container of volume 2.3 L and a temperature of 32°C exerts a pressure of 4.7 atm. Calculate the number of moles of gas present. (Note: The AP curriculum tends to present pressures in atm rather than kPa. As a result, the value for R will be $0.08206 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ instead of $8.31 \text{ L}\cdot\text{kPa}/\text{mol}\cdot\text{K}$)

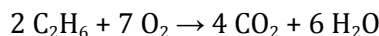
32. Given that 6.9 moles of carbon monoxide gas are present in a container with volume 30.4 L, what is the pressure of the gas (in atm) if the temperature is 62°C ?

33. Methane, the principal component of natural gas, is used for heating and cooking. The combustion process is:



If 15.0 moles of CH_4 are reacted, what is the volume of CO_2 in liters produced at 23.0°C and 0.985 atm?

34. Ethane combust in a vessel that can change volume according to the following:



If 25.0 g of ethane reacts with 50.0 g of oxygen, what volume of gas is there when the reaction completes, if this takes place at 1.52 atm and 125°C ? (Note: All of the species are gasses, so you must account for both products and whatever remains of the excess reagent.)