

For New  
Curriculum Framework

# AP Chemistry

# **SUMMER**

# **ASSIGNMENT**

**Topic 1:** Significant Figures

**Topic 2:** Metric and Temperature Conversions

**Topic 3:** Nomenclature (inorganic and covalent)

**Topic 4:** Atomic Structure

**Topic 5** Writing and Balancing Chemical Equations

**Topic 6:** Moles and Stoichiometry

**Topic 7:** Graphing and Data Analysis

Topic 8: Particulate Diagrams

**Topic 9:** Elements and Ions to Memorize



The Triple Point

# AP Chemistry Summer Assignment

|                |  | Due Date |
|----------------|--|----------|
| <b>Topic 1</b> | Significant Figures                                    | 8/19     |
| <b>Topic 2</b> | Metric and Temperature Conversions                     | 8/19     |
| <b>Topic 3</b> | Nomenclature   | 8/19     |
| <b>Topic 4</b> | Atomic Structure                                       | 8/19     |
| <b>Topic 5</b> | Writing and Balancing Chemical Equations               | 8/19     |
| <b>Topic 6</b> | Moles and Stoichiometry                                | 8/19     |
| <b>Topic 7</b> | Graphing and Data Analysis                             | 8/19     |
| <b>Topic 8</b> | Particulate Drawings                                   | 8/19     |
| <b>Topic 9</b> | Elements and Ions to Memorize<br>(Prepare Flash Cards) | 8/19     |

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AP CHEMISTRY PREP

## Topic 1: Significant Figures

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1. Determine the number of significant figures in each of the following:

- a. 0.7540
- b. 12500
- c. 10000.01
- d. 1200
- e.  $1.04 \times 10^3$
- f. 0.0080050

2. Perform the following calculations and round to the appropriate number of significant figures.

- a.  $34.66 + 333.0$
- b.  $1.23 + 9.66$
- c.  $445 - 1.22$
- d.  $18.2 \times 1.998$
- e.  $10.2 \div 1.34$
- f.  $\frac{100.23 + 59.4}{5.22}$

3. Round each of the following numbers to three significant figures.

- a. 167.789
- b. 0.00000445345
- c. 25.0545
- d. 3.1415926536
- e. 8504.0435
- f. 14.4355

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## Topic 2: Metric and Temperature Conversions

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1. Use dimensional analysis (factor-label method) to make the following metric conversions:

- a. 3.40 m to cm
- b. 289 cm to nm
- c. 125145 J to kJ
- d. 164 mg to g
- e. 46.5 mL to L

2. Make the following temperature conversions.

- a. 162°F to °C
- b. 0.0 °F to K
- c. -18 °C to K
- d. 212 K to °C
- e. 98.6 °F to K

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## Topic 3: Nomenclature

1. Name or write the formula for the following ionic compounds:

|                                   |  |                           |  |
|-----------------------------------|--|---------------------------|--|
| a. LiCl                           |  | g. tin(II) bromide        |  |
| b. Mg(OH) <sub>2</sub>            |  | h. potassium phosphate    |  |
| c. K <sub>3</sub> P               |  | i. nickel(II) perchlorate |  |
| d. Fe <sub>2</sub> O <sub>3</sub> |  | j. sodium hydroxide       |  |
| e. FeO                            |  | k. zinc phosphate         |  |
| f. ZnCl <sub>2</sub>              |  | l. ammonium sulfate       |  |

2. Name or write the formula for the following covalent compounds:

|                                  |  |                              |  |
|----------------------------------|--|------------------------------|--|
| a. CO                            |  | e. nitrogen tribromide       |  |
| b. CBr <sub>4</sub>              |  | f. tetraphosphorus decaoxide |  |
| c. SO <sub>2</sub>               |  | g. xenon hexafluoride        |  |
| d. N <sub>2</sub> O <sub>4</sub> |  | h. dicarbon tetrafluoride    |  |

3. Name or write the formula for the following acids:

|  |  |                       |  |
|--|--|-----------------------|--|
| a. HCl   |  | e. hydrobromic acid   |  |
| b. HNO <sub>3</sub>                              |  | f. hydronitric acid   |  |
| c. HC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> |  | g. phosphoric acid    |  |
| d. H <sub>2</sub> SO <sub>4</sub>                |  | h. hydrosulfuric acid |  |

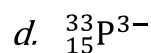
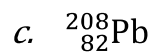
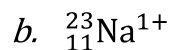
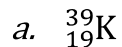
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## Topic 4: Atomic Structure

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1. Determine the number of protons, neutrons and electrons in each of the following:



2. Write the symbol for the atom that contains

a. 24 protons, 21 electrons and 24 neutrons

b. 34 protons, 45 neutrons, 34 electrons

c. 8 protons, 10 neutrons, 10 electrons

3. What experimental evidence supports these statements?

a. The nucleus of an atom is small.

b. The atom consists of both positive and negative charges.

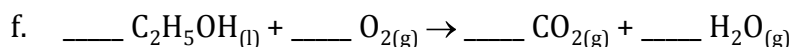
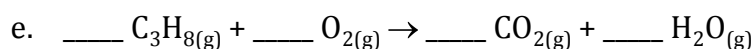
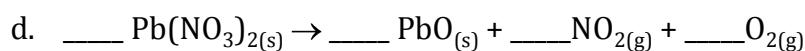
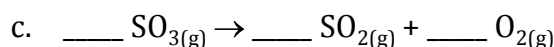
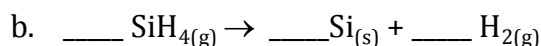
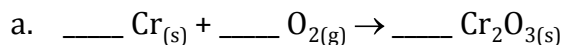
c. The nucleus of the atom is positive.

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## Topic 5: Writing and Balancing Chemical Equations

1. Balance the following chemical equations



2. Write a balanced chemical equation for each of the following reaction descriptions.

a. When solid calcium carbonate is heated, solid calcium oxide and gaseous carbon dioxide are formed.

b. Aluminum metal reacts with oxygen to form solid aluminum oxide.

c. When solid mercury(II) sulfide is heated with oxygen, liquid mercury metal and gaseous sulfur dioxide are produced.

d. When aqueous solutions of aluminum sulfate and barium chloride are mixed, solid barium sulfate and aqueous aluminum chloride are formed.

e. Solid sodium bicarbonate reacts with hydrochloric acid to produce sodium chloride, water, and carbon dioxide gas.

f. Gaseous ammonia and oxygen react to produce nitrogen monoxide gas and water vapor.

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## Topic 6: Moles and Stoichiometry

1. Vinegar is a dilute solution of acetic acid,  $\text{CH}_3\text{COOH}$ .
  - a. Calculate the molar mass of acetic acid.
  - b. How many molecules of  $\text{CH}_3\text{COOH}$  are contained within 43.4 g of acetic acid?
  - c. How much would 0.450 moles of acetic acid weigh?
2. How many moles of hydrogen gas can be produced if 1.35 g of solid zinc reacts with excess hydrochloric acid according to the equation
$$\text{Zn} + 2 \text{HCl} \rightarrow \text{H}_2 + \text{ZnCl}_2$$
3. The reaction for the combustion of propane is
$$\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$$
  - a. If 20.0 g of  $\text{C}_3\text{H}_8$  and 20.0 g of  $\text{O}_2$  are reacted, how many moles of  $\text{CO}_2$  can be produced?
  - b. If 20.0 g of  $\text{C}_3\text{H}_8$  and 80.0 g of  $\text{O}_2$  are reacted, how many grams of  $\text{CO}_2$  can be produced?



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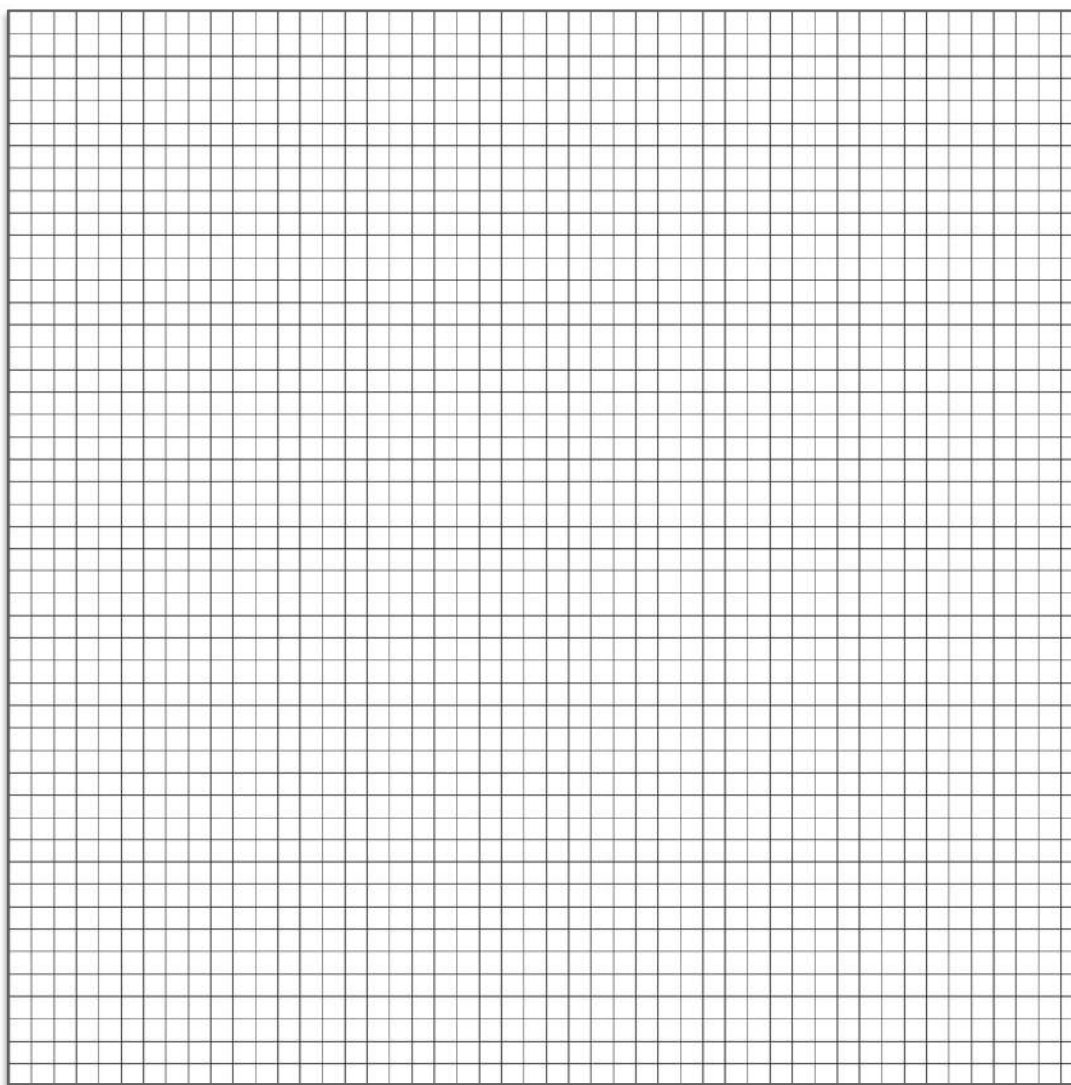
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## Topic 7: Graphing and Data Analysis

- When anhydrous calcium chloride is dissolved in water, the temperature of the system changes. A student obtains the following data when dissolving increasing amounts of  $\text{CaCl}_2$  into 100 mL of water:

|                                      |      |      |      |      |       |
|--------------------------------------|------|------|------|------|-------|
| Mass of $\text{CaCl}_2$ dissolved, g | 0.91 | 2.94 | 5.92 | 8.81 | 10.89 |
| $\Delta T$ , $^{\circ}\text{C}$      | 1.8  | 6.6  | 12.8 | 18.9 | 23.2  |

Plot the data on the graph below. Choose an appropriate scale, and label the axes appropriately.



*Refer to the graph to answer the following questions.*

Independent Variable:

Dependent Variable:

Provide a descriptive title for the graph:

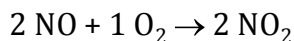
2. Describe the relationship between grams of calcium chloride salt and change in temperature in a sentence.
  
2. Draw a line of best fit. Determine its slope, including units.
  
3. Predict the change in temperature when
  - a. 4.33 g of  $\text{CaCl}_2$  are dissolved
  
  - b. 9.56 g of  $\text{CaCl}_2$  are dissolved
  
  - c. 15.4 g of  $\text{CaCl}_2$  are dissolved
  
4. Predict what mass of  $\text{CaCl}_2$  will result in
  - a. a  $12.4^\circ\text{C}$  change in temperature
  
  - b. a  $44.9^\circ\text{C}$  change in temperature

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## Topic 8: Particulate Drawings

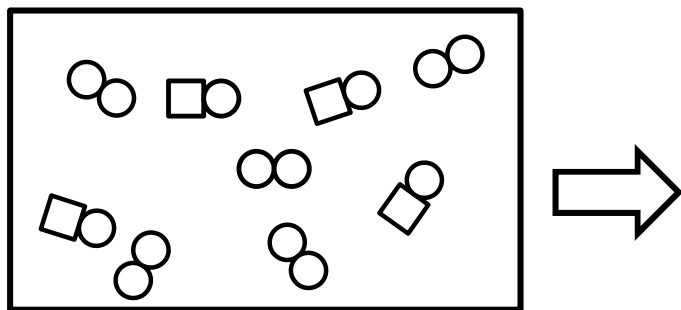
1. Consider the synthesis of nitrogen dioxide



- a. In the diagram below, nitrogen atoms are represented with squares and oxygen atoms are represented with circles. Using the conservation of matter, draw what you would expect to find in the reaction vessel once the reaction is complete.

Before Reaction:

After Reaction



Limiting Reactant:

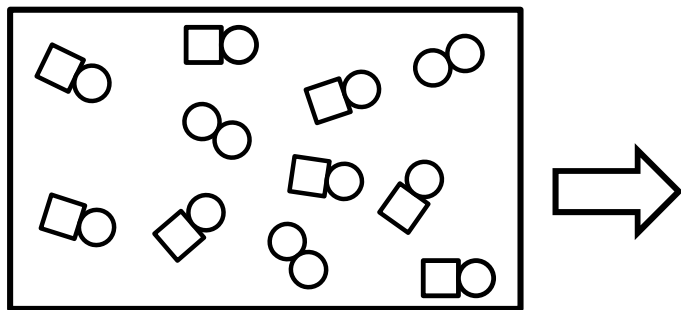
Excess Reactant:

Explanation

- b. Consider the same reaction, with different starting quantities. Draw the contents of the reaction vessel after the reaction is complete.

Before Reaction:

After Reaction



Limiting Reactant:

Excess Reactant:

Explanation

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## Topic 9: Elements and Ions to Memorize

1. Prepare flash cards for the following elements/ions and their symbols.

|    |            |
|----|------------|
| H  | hydrogen   |
| He | helium     |
| Li | lithium    |
| Be | beryllium  |
| B  | boron      |
| C  | carbon     |
| N  | nitrogen   |
| O  | oxygen     |
| F  | fluorine   |
| Ne | neon       |
| Na | sodium     |
| Mg | magnesium  |
| Al | aluminum   |
| Si | silicon    |
| P  | phosphorus |
| S  | sulfur     |
| Cl | chlorine   |
| Ar | argon      |
| K  | potassium  |
| Ca | calcium    |
| Cr | chromium   |
| Mn | manganese  |
| Fe | iron       |
| Cu | Copper     |
| Zn | zinc       |
| Ag | silver     |
| Pb | lead       |

|                                    |              |
|------------------------------------|--------------|
| $\text{C}_2\text{H}_3\text{O}_2^-$ | acetate      |
| $\text{ClO}_3^-$                   | chlorate     |
| $\text{ClO}_2^-$                   | chlorite     |
| $\text{CN}^-$                      | cyanide      |
| $\text{HCO}_3^-$                   | bicarbonate  |
| $\text{OH}^-$                      | Hydroxide    |
| $\text{NO}_3^-$                    | nitrate      |
| $\text{NO}_2^-$                    | nitrite      |
| $\text{ClO}_4^-$                   | perchlorate  |
| $\text{MnO}_4^-$                   | permanganate |
| $\text{SCN}^-$                     | thiocyanate  |
| $\text{CO}_3^{2-}$                 | carbonate    |
| $\text{CrO}_4^{2-}$                | chromate     |
| $\text{SO}_4^{2-}$                 | sulfate      |
| $\text{SO}_3^{2-}$                 | sulfite      |
| $\text{PO}_4^{3-}$                 | phosphate    |
| $\text{PO}_3^{3-}$                 | phosphite    |
| $\text{NH}_4^+$                    | ammonium     |