

## **AP Chemistry Summer Assignment June-July 2020**

Future AP Chemistry Parents and Students,

Welcome to AP Chemistry. In order to ensure the best start for everyone next fall, I have prepared a summer assignment that reviews basic chemistry concepts. With the ready access to hundreds of websites, either in your home or at the local library, I am confident that you will have sufficient resources to prepare adequately for the fall semester.

As you are probably aware, the Advance Placement Program of the College Board is designed to let students in high school obtain college credit and/or advanced placement above the introductory course level at the college they attend. This is a program of credit by examination. The College Board hires the Education Testing Service (ETS) to write and grade the AP Exams. Needless to say it is a very challenging exam and will push each student. Grades on the exam are assigned on a 1-5 scale with most colleges giving some credit for a "3". You should contact the colleges of your choice to learn just what score will be needed to receive credit.

In order to give college credit, the nation's colleges expect that AP classes will be equivalent to college level courses. In chemistry, this means we will do college level labs using more sophisticated equipment than you had in your Chemistry I class.

Each student and parent should not be surprised by course requirements that are in excess of what you would expect from an honors level course. It is not unusual for a student to be responsible for several assignments at the same time. For example, there will be homework problems from the text as well as homework problems from old AP exams. Students will be given a syllabus and are expected to keep up with assignments without much prompting from the teacher.

Much of the material in this summer packet will be familiar to you. While I review, extensive remediation is not an option as we work towards our goal of being 100% prepared for the AP Exam in early May. There will be a test covering the basic concepts included in the summer packet during the first week of school.

You may contact me by email ([Elizabeth.Link@richlandone.org](mailto:Elizabeth.Link@richlandone.org)) this summer. I will do my best to answer your questions as soon as possible.

Finally, I recommend that you spread out the summer assignment. Please do not try to complete it all in the final week of the summer. Chemistry takes time to process and grasp at a level necessary for success in AP Chemistry. Taking a college level course in high school is difficult, requires dedication, and is a great investment in your education so prepare yourself and arrive ready to learn.

Have a great summer and enjoy studying chemistry.

-E. Link

**The following assignment is to be completed on lined paper and submitted on the first day of school.**

**If you choose to make flashcards, they do not need to be turned in.**  
**YOU MUST SHOW WORK FOR ALL MATHEMATICAL PROBLEMS.**

- Write the most common guidelines to determine significant figures (digits) with an example.
- Convert the following:
  - 515 m = \_\_\_ miles.
  - 200 in = \_\_\_\_\_ meters
  - 325 days = \_\_\_\_\_ seconds.
  - 20 gallons = \_\_\_\_\_ ml
- Classify each of the following as units of mass, volume, length, density, energy, or pressure.  
a. mg      b. mL      c. cm<sup>3</sup>      d. mm      e. kg/m<sup>3</sup>      f. kJ      g. atm      h. cal.
- Some laboratory experiments are performed at 55°C. Express this temperature in:
  - °F
  - K
- A cylindrical rod formed from silicon is 21.3 cm long and has a mass of 5.00 kg. The density of silicon is 2.33 g/cm<sup>3</sup>. What is the diameter of the cylinder? (the volume of cylinder is given by  $V = \pi r^2 h$ , where r is the radius and h is the length)
- How many **significant figures** are in each of the following?
  - 1.92 mm
  - 0.030100 kJ
  - $6.022 \times 10^{23}$  atoms
  - 460.00 L
  - 0.00036 cm<sup>3</sup>
  - 100
  - 1001
  - 0.001
  - 0.0101
- Record the following in correct **scientific notation**:
  - 350,000,000 cal
  - 0.0000721 mol
  - 0.0000000809 Å
  - 765,400,000,000 atoms
- Calculate the following to the **correct number** of significant figures.
  - $1.27 \text{ g} / 5.296 \text{ cm}^3$
  - $12.235 \text{ g} / 1.01 \text{ L}$
  - $12.2 \text{ g} + 0.38 \text{ g}$
  - $17.3 \text{ g} + 2.785 \text{ g}$
  - $2.1 \times 3.21$
  - $200.1 \times 120$
  - $17.6 + 2.838 + 2.3 + 110.77$
- Give the **chemical symbols** for the following elements:
  - Carbon
  - sulfur
  - Titanium
  - Nitrogen
  - Helium
  - Krypton
  - Fluorine
  - Scandium
  - Arsenic

10. Write the name for each of the elements symbols:
- |       |       |       |       |
|-------|-------|-------|-------|
| a. Na | b. Au | c. Ag | d. Sn |
| e. Fe | f. Hg | g. K  |       |
11. Label each of the following as either a **physical process** or a **chemical process**.
- Corrosion of aluminum metal.
  - Melting of ice.
  - Pulverizing an aspirin.
  - Digesting a candy bar.
  - Explosion of nitroglycerin.
  - Milk turning sour.
  - Burning of paper.
  - Forming of frost on a cold night.
  - Bleaching of hair with hydrogen peroxide.
  - A copper wire is hammered flat.
12. Calculate the mass of O<sub>2</sub> produced if 3.450 g potassium chlorate is completely decomposed by heating in presence of a catalyst (Manganese dioxide).
13. Write the formula of the following compounds? (Use **criss-cross** method)
- |                           |                       |                        |
|---------------------------|-----------------------|------------------------|
| a. Calcium Sulfate.       | b. Ammonium Phosphate | c. Lithium Nitrite     |
| d. Potassium Perchlorate. | e. Barium Oxide       | f. Zinc Sulfide.       |
| g. Sodium Perbromate      | h. Calcium Iodide     | i. Aluminum Carbonate. |
14. Convert **6.75 atm** to:
- |          |            |
|----------|------------|
| a. mm Hg | b. pascals |
|----------|------------|
15. Define the words: **atomic number, atomic mass, mass number, molecular formula, structural formula, empirical formula, isotopes, cation, anion, and metalloid**.
16. Determine **number of protons and neutrons** in each of the following.
- |                           |                              |                             |                           |
|---------------------------|------------------------------|-----------------------------|---------------------------|
| a. ${}_{19}^{39}\text{K}$ | b. ${}_{11}^{23}\text{Na}$ . | c. ${}_{82}^{208}\text{Pb}$ | d. ${}_{15}^{33}\text{P}$ |
|---------------------------|------------------------------|-----------------------------|---------------------------|
17. White gold is an alloy that typically contains 45.0% by mass gold and the remainder is platinum. If **154 g** of gold are available, how many grams of platinum are required to combine with the gold to form this alloy?
18. What is the empirical formula of a compound that contains 53.73% Fe and 46.27% of S ?
19. Determine the number of molecules present in 4.56 mol of nitrogen (N<sub>2</sub>).
20. List the following as diatomic molecule, molecular (aka covalent) compound, ionic compound or element.
- |   |                    |                   |                   |       |                                   |                   |       |
|---|--------------------|-------------------|-------------------|-------|-----------------------------------|-------------------|-------|
| a. F <sub>2</sub>                         | b. Cl <sub>2</sub> | c. C              | d. NaCl           | e. KF | f. CO <sub>2</sub>                | g. H <sub>2</sub> | h. Ag |
| i. Rust (Fe <sub>2</sub> O <sub>3</sub> ) | j. MgO             | k. O <sub>2</sub> | l. I <sub>2</sub> | m. CO | n. K <sub>2</sub> CO <sub>3</sub> |                   |       |

21. State the contribution of the following chemist in one line.  
a. Democritus    b. Mendeleev    c. J.J Thompson
22. What is the difference between:  
a. Chlorine and Chloride?  
b. Sodium atom and Sodium ion.
23. How many grams of methane (CH<sub>4</sub>) are present in 5.6 moles of methane gas?
24. Calculate the **mass in grams** of each of the following:  
a.  $6.02 \times 10^{23}$  atoms of Mg.  
b.  $3.01 \times 10^{23}$  atoms of CaCl<sub>2</sub>.  
c.  $12.4 \times 10^{15}$  atoms of neon.
25. In an experiment, a student gently heated a hydrated copper compound to remove the water of hydration. The following data was recorded:  
1. Mass of crucible, cover, and contents before heating 23.4 g.  
2. mass of empty crucible and cover 18.82 g.  
3. mass of crucible, cover, and contents after heating to constant mass 20.94 g.  
Calculate the experimental percent of water in the compound.
26. How do you distinguish:  
a. An element from a compound.  
b. An element from a mixture.  
c. A true solution from a heterogeneous mixture.
27. Define acid, base and salt? Give some examples of each.
28. Write the chemical formulas for the following compounds:  
a. Calcium Carbonate    b. Ammonium Phosphate    c. Sodium Chloride  
d. Sodium Oxide    e. Calcium Sulfate    f. Sodium Nitrite  
g. Magnesium Acetate    h. Potassium Cyanide    i. Zinc(II) Nitrate  
j. Iron(III) Phosphate    k. Nickel (II) Fluoride
29. Define- Law of conservation of mass.
30. Calculate the molar masses (g/ mol) of  
a. Ammonia (NH<sub>3</sub>)  
b. Baking Soda (NaHCO<sub>3</sub>)  
c. Osmium Metal (Os)
31. Convert the following to moles  
a. 3.86 grams of Carbon dioxide.  
b.  $6.0 \times 10^{-5}$ g of Hydrazine (N<sub>2</sub> H<sub>4</sub>), a rocket propellant.
32. The molecular formula of morphine, a pain-killing narcotic, is C<sub>17</sub>H<sub>19</sub>NO<sub>3</sub>.  
a. What is the molar mass?  
b. What fraction of atoms in morphine is accounted for by carbon?  
c. Which element contributes least to the molar mass?

33. Complete the list of ionic compounds (name or formula)
- Cupric Hydroxide
  - Strontium Chromate
  - Ammonium Perchlorate
  - $\text{NaHCO}_3$
  - $\text{Fe}_2(\text{CO}_3)_3$
  - Sodium Hydroxide.
  - Potassium Chloride.
34. The hormone, thyroxine is secreted by the thyroid gland, and has the formula:  $\text{C}_{15}\text{H}_{17}\text{NO}_4\text{I}_4$ . How many milligrams of Iodine can be extracted from 15.0 Grams of thyroxine?
35. Determine the **formula weight** (aka molar mass) for the following:
- $\text{N}_2\text{O}_5$
  - $\text{CuSO}_4$
  - $\text{Ca}(\text{HCO}_3)_2$
  - $\text{CaSO}_4$
36. What is the molecular formula of each of the following compounds?
- Empirical formula  $\text{CH}_2$ , molar mass = 84g/mol.
  - Empirical formula  $\text{NH}_2\text{Cl}$ , molar mass = 51.5 g/ mol
37. DEFINE limiting reagent, theoretical yield, and actual yield?
38. Sodium hydroxide reacts with carbon dioxide as follows:
- $$2 \text{NaOH}(\text{s}) + \text{CO}_2(\text{g}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$$
- Which reagent is the limiting reactant when 1.85 mol of sodium hydroxide and 1.00 mol carbon dioxide are allowed to react? How many moles of sodium carbonate can be produced?
39. One way to remove Nitrogen Oxide (NO) from smokestack emissions is to react it with ammonia:
- $$4 \text{NH}_3(\text{g}) + 6 \text{NO}(\text{g}) \rightarrow 5 \text{N}_2(\text{g}) + 6 \text{H}_2\text{O}(\text{l})$$
- Fill in the blanks below:
- 12.3 mol of NO reacts with \_\_\_\_\_ mol of ammonia.
  - 5.87 mol NO yields \_\_\_\_\_ mol nitrogen.
40. Name the following:
- $\text{CO}_2$
  - $\text{P}_4\text{S}_{10}$
  - $\text{NI}_3$
  - $\text{PCl}_5$
  - $\text{CCl}_4$
  - $\text{SF}_6$
  - $\text{CH}_4$
  - $\text{C}_2\text{H}_6$
  - $\text{C}_3\text{H}_8$

41. A sample of carbon dioxide gas,  $\text{CO}_2$  (g), occupies a volume of 5.75 L at 0.890 atm. If the temperature and the number of moles remain constant, calculate the volume when the pressure
- increases to 1.25 atm
  - decreases to 0.350 atm
42. A nitrogen sample at  $30^\circ\text{C}$  has a volume of 1.75L. If the pressure and the amount of gas remain unchanged, determine the volume when the Celsius temperature is doubled.
43. On a warm day, an amusement park balloon is filled with 47.8 g He. The temperature is  $33^\circ\text{C}$  and the pressure in the balloon is 2.25 atm. Calculate the volume of the balloon.
44. DDT, an insecticide harmful to fish, birds, and humans, is produced by the following reaction:



If 1142 g of chlorobenzene is reacted with 485 g of chloral,

- What mass of DDT is formed?
- Which reactant is limiting? Which is in excess?
- What mass of excess reactant is left over?
- If the actual yield of DDT is 200.0 g, what is the percent yield?

## Write formulas for the following

**You MUST know the charges of the monatomic cations and anions.**

**You MUST know the charges of the polyatomic ions. (use your Chemistry H sheet).**

### Common monoatomic ions

D)	Name	Symbol( Ion)
a)	Sodium	$\text{Na}^{+1}$ (example)
b)	Potassium	
c)	Cesium	
d)	Beryllium	
e)	Calcium	
f)	Strontium	
g)	Barium	
h)	Gallium	
i)	Aluminum	
j)	Nitrogen	
k)	Arsenic	
l)	Bismuth	
m)	Oxygen	
n)	Fluorine	
o)	Chlorine	
p)	Bromine	
q)	Iodine	

### Common ions of transition elements

Ion Name	Ion
a) Chromium(III)	
b) Manganese(II)	
c) Iron(II)	
d) Iron(III)	
e) Cobalt(II)	
f) Nickel(II)	
g) Copper(II)	
h) Zinc	
i) Silver	
j) Cadmium	
k) Mercury(II)	

### Common Polyatomic Ions

Name	Formula	Name	Formula
a) Acetate		b) Ammonium	
c) Carbonate		d) Chlorate	
e) Chlorite		f) Chromate	
g) Cyanide		h) Dichromate	
i) Phosphate		j) Carbonate	
k) Hypochlorite		l) Hydroxide	
m) Nitrate		n) Nitrite	
o) Oxalate		p) Perchlorate	
q) Permanganate		r) Phosphate	
s) Sulfate		t) Sulfite	