## 2023 – 2024 PRE-AP CHEMISTRY

## SUMMER ASSIGNMENT

Dear Future Chemistry Students,

Welcome to Pre-AP Chemistry! I am excited about the upcoming year of Chemistry. To help you get your brains in gear and prepared to enter chemistry, I have prepared a summer assignment to be completed by Wednesday, 8:00 AM, August 16th, 2023. Your first test will be Thursday, August 17th, over the information covered in the summer assignment and the first three chapters of the book.

Your first task is log into your chemistry textbook through the Holt McDougal site via Classlink. You will need to read the ***first three chapters*** in the chemistry book. It is not required but suggested that you complete the chapter reviews at the end of the first three chapters. This will help you with the summer assignment test.

Your second task is to log into Google Classroom **(access code: etmsj4t)** and join my summer Chemistry Classroom by the end of the current school year. This is where you will turn in various portions of the summer assignment and where can ask me questions about the content you are covering as well. .

Lastly, you need to complete the summer assignment packet and experiment. They are both due Wednesday, 8:00 AM, August 16th, 2023. The experiment portion of the summer assignment (google slide presentation) will be submitted via google classroom (Experiment submission). If you have any questions regarding these assignments, please contact me through Google Classroom or by email.

Many of the topics covered in this assignment will be a review for you, for example, metric conversions and significant figures. I have included some reference materials and QR codes in the summer assignment; however, there are also many resources that are available online as well. I encourage you to be diligent in your pursuit of understanding these basic concepts since they will be used all year long. If you have questions or need to contact me during the summer you can reach me via email at katherine.calloway@silsbeeisd.org or through Google Classroom. I will do my best to get back to you ASAP.

In closing, I encourage you to not wait until the last minute to complete the assignment. It is not possible to complete this assignment quickly. If you do not complete the summer assignment on time you will receive a schedule change to an on-level chemistry class. You will need to commit time during the summer to complete it. Procrastination only leads to poor study habits and high stress levels and neither is good for you or your grade! So, come to class in August prepared to hit the ground running! I look forward to working with each of you!

See you in August!

Katherine E. Calloway

Mrs. Katherine Calloway

# PART I

# EXPERIMENT DESIGN AND PERFORMANCE

## EXPERIMENT

### PART A – Choosing a topic for your experiment

This section will take commitment and time from you during the summer. You will need to choose a topic to conduct an experiment over (see list below). You will need to inform me via ***GOOGLE CLASSROOM 'EXPERIMENT APPROVAL ASSIGNMENT' by June 10th 11:59 PM*** of the experiment you will be conducting. The experiment you choose should be conducted using only **HOUSEHOLD** chemicals and **FOOD ITEMS**. There will be no need to purchase expensive chemicals. ***NO CHEMICALS THAT WILL EXPLODE!!! NO EXPLOSIONS OR FLAMES!*** You may want to research topics such as "chemistry experiments at home; household chemistry; easy chemistry for kids; easy home chemistry experiments". If you google the before mentioned topics it will give you hundreds of experiments to choose from.

Topics to consider:

The following categories are the ones you will choose from:

1. mixture creation and separation

2. acids / bases – testing for degree of acidity using a fruit indicator

3. solubility

4. gas laws

5. physical properties; density, viscosity, etc.

6. chemical properties – reactivity, color changes etc.

7. endothermic / exothermic reactions

**Topic Choice:** _____

**You must complete the google form on google classroom by *June 10th 2023* @11:59 PM to let me know the topic chosen and details about your experiment. If you do not complete this form on time, I will assume that you do not want to complete the summer assignment and your schedule will be changed to an on-level chemistry class for the fall.**

### PART B – EXECUTING THE EXPERIMENT ( 70 points)

It is now time to execute your experiment. The outline below will help you stay organized and produce a quality lab report/presentation.

I. Which topic will be the focus of the experiment?
II. Identify the components:
   a. **A problem statement** (or question)
   b. **Independent variable**
   c. **Dependent variable**
   d. **Control group** (may not have this with a chemistry experiment)
   e. **Experimental constants**
   f. **Hypothesis**
   g. **Materials used** (listed in columns left, middle and right)

h. **The procedure** will have instructions for the experiment to be repeated. It will have:
    i. A set of **step-by-step instructions** to complete the experiment which will be written in a way that the experiment can be repeated EXACTLY the same way.
    ii. Amount of materials used
    iii. Pictures of the procedures
i. **Data collection table** should be included to collect and record all the quantitative data.
j. **Journal entries with written observations.**
    i. Each time the experiment is observed a written documentation should be made.
    ii. Pictures documenting the progress of the experiment should be made.
k. **Analysis and conclusions.** Use complete sentences during this part of your report. Please include:
    i. Explanation of data and results.
    ii. Graph of the data collection table.
    iii. Answer: Was my hypothesis valid? Did my experiment prove my hypothesis correct? Does the data support this?
    iv. Were there any external factors that affected the outcome of the experiment?

**PART C - Lab report / PowerPoint or Google Slide:**

You will be responsible for creating a lab report in PowerPoint / Google Slide format to accompany your lab experiment. Each slide will contain a section of the lab report. An example of the lab report and content for each section is below:

| | |
|---|---|
| Section I (slide 1): | Title: (creative, informative, appropriate) **5 pts** |
| Section II (slide 2): | Introduction: (introduce topic, define terms, state hypothesis) **15 pts** |
| Section III (slide 3): | Materials: (listed in columns) **5 pts** |
| Section IV (slide 4): | Procedures: (numbered, complete sentences, short, direct, one-step procedures)20pts |
| Section V (slide 5): | Results/Data: (data tables, graphs, calculations) **30pts** |
| Section VI (slide 6): | Discussion and conclusion: (interpretation of data, graphs, results and analysis, state findings related to introduction and established hypothesis, support findings with data, graphs, and/or analysis). **15 pts** |

**POWERPOINT REQUIREMENTS:** 1. one or more slides for each section of the lab report (at minimum six slides – you should easily have more slides than this because of the pictures – see above for descriptions)

2. You must include the following pictures:

    a. set up of all "chemicals" and equipment before you begin the lab

    b. two or more pictures of the lab while in progress

    c. one of more pictures of the final product

    ***you must be in at least 2 of the pictures. ***

3. each slide must contain writing and explanation – not just pictures

The experiment PowerPoint / Google Slides presentation is due via ***Google Classroom by 8:00 AM, August 16, 2023.*** You will need to submit that Via Google Classroom in the manner explained to you during our Summer Project discussion on 5/18/23. If it is not submitted correctly through Google Classroom (turned in - NOT SHARED) it will be accepted, but not for full credit. You will only be able to receive a maximum grade of 70.

# PART II

# SUMMER ASSINGMENT REVIEW CONCEPTS

The concepts in this packet are concepts that should be review for you. These are concepts that you were taught from $4^{th}$ – $8^{th}$ grade. They are essential concepts that you need to know to be successful in Pre-AP chemistry. Without these concepts, you will not have the basic knowledge to be successful. If you are struggling with these, I encourage you to contact me or use the resources you have available like your book or videos by Tyler Dewitt.

NAME: _____

# PRE-AP CHEMISTRY SUMMER ASSIGNMENT

**Precision** is a measurement of how close a series of measurement are to one another. Estimating error is a way of quantifying the precision of you measurements.

Percent error = (measured value – accepted value) X 100

Accepted value

Average mean – sum of all measurements / # of measurements

Ex: 5.50 cm, 5.49 cm, 5.53 cm, 5.48 cm, and 5.52 cm

Average – 27.52 / 5 = 5.50 cm

https://www.youtube.com/watch?v=loduc50moIQ

Deviation – (Experimental value – Average mean)

Ex: (5.50 – 5.50) = 0

(5.49 – 5.50) = 0.01

(5.53 – 5.50) = 0.03

(5.48 – 5.50) = 0.02

(5.52 – 5.50) = 0.02

Degree of uncertainly = average of deviation

(0+0.01+0.03+0.02+0.02)/5 = 0.016 cm

5.50 cm ± 0.016 cm

## Determining Error

The accepted density for lead is 11.3 g/ml. Five lab groups attempted to deterring the density and recorded the following data: Lab group 1 = 11.3 g/ml lab group 2 = 11.1 g/ml lab group 3 = 11.2 g/ml

Lab group 4 = 11.5 g/ml lab group 5 = 11.6 g/ml

1. Calculate the error for each group

2. Calculate the average mean of the data

3. Calculate the deviation for each group

4. Omit

5. Calculate the degree of uncertainty for the lab data.

**Accuracy** is a measure of how close a measurement comes to the actual or true value of whatever is measured.

A measurement can only be as accurate and precise as the instrument that produced it. A scientist must be able to express the accuracy of a number, not just its numerical value. We can determine the accuracy of a number by the number of **significant figures** it contains.

Rules for Significant Figures

❶ All nonzero figures are significant.

721 mm — 3 significant figures

❷ When a zero falls between nonzero digits, or trapped zeros, that zero is significant.

106 K — 3 significant figures

❸ When a zero falls after the decimal point and after a significant figure, that zero is significant.

1.50 L — 3 significant figures

❹ When a zero is used merely to indicate the position of the decimal, that zero is not significant.

1 210 m — 3 significant figures

0.053 m — 2 significant figures

❺ All counting numbers and exact numbers are treated as if they have an infinite number of significant figures.

10 pairs — infinite number of significant figures

# SIGNIFICANT FIGURES

The last digit of a measurement expression is uncertain. That is because the last digit is an estimation.

Significant figures in a measurement expression comprise all digits that are known with certainty, plus one digit that is uncertain. PLACEHOLDERS ARE NOT SIGNIFICANT! Please reference the rules for Sig Figs preceding this page before completing the work below.

**A. State the number of significant digits in each measurement.**

1) 2804 m ____ 2) 2.84 km ____ 3) 5.029 m _____

4) 0.003068 m _____ 5) $4.6 \times 10^5$ m _____ 6) $4.06 \times 10^{-5}$ m _____

7) 750 m _____ 8) 75 m _____ 9) 75,000 _____

10) 75.00 _____ 11) 75,000.0 m _____ 12) 10 cm _____

https://www.youtube.com/watch?v=eCJ76hz7jPM

**B. Round the following numbers as indicated:**

**To four figures:**

11) 3.682417 _____ 12) 21.860051 _____ 13) 375.6523 _____ 14) 112.511 _____ 15) 45.4673 _____

**To one decimal place:**

16) 1.3511 _____ 17) 2.473 _____ 18) 5.687524 _____ 19) 7.555 _____ 20) 8.235 _____

**To two decimal places:**

21) 22.494 _____ 22) 79.2588 _____ 23) 0.03062 _____ 24) 3.4125 _____ 25) 41.86632 _____

26) 22.50 _____ 27) 79.26 _____ 28) 0.03 _____ 29) 3.41 _____ 30) 41.87 _____

# CALCULATING USING SIGNIFICANT FIGURES

**RULES FOR MULTIPLYING AND DIVIDING:**

When multiplying and dividing, round to the least number of significant figures in any of the factors.

EXAMPLE 1: 23.0 cm x 432 cm x 19 cm = 188,784 $cm^3$

The answer is expressed as 190,000 $cm^3$ since 19 cm has only 2 significant figures.

**RULES FOR ADDING ANS SUBTRACTING:**

When adding and subtracting, round your answer to the least number of decimal places in any of the numbers that make up your answer.

EXAMPLE 2: 123.25 mL + 46.0 mL + 86.257 mL = 255.507 mL

The answer is expressed as 255.5 mL since 46.0 mL has only one decimal place.

**C. *Show your work* and solve the following problems and report answers with appropriate number of significant digits.**

1) 6.201 cm + 7.4 cm + 0.68 cm +12.0 cm =

2) 1.6 m + 1.62 m +1200 m =

https://www.youtube.com/watch?v=iorZdz4dsBU

3) 8.264 g - 7.8 g =

4) 10.4168 m - 6.0 m =

https://www.youtube.com/watch?v=xHgPtFUbAeU

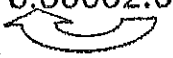
5) 12.00 m+15.001 kg=

6) 1.31 cm x 2.3 cm =

7) 5.7621 m x 6.201 m =

# Scientific Notation Notes

| | | |
|---|---|---|
| What is Scientific Notation? | A way to write very large or very small numbers more easily (takes up less space and less likely to make mistakes). Often used by scientists.<br><br>$3.45 \times 10^9$ instead of 3,450,000,000 | |
| Definition | A number is in scientific notation when it has a number between 1 and 10 multiplied by 10 to a power.<br>Which of the following are in Scientific Notation? Explain.<br>(circled) $4.69 \times 10^{-8}$ $56.7 \times 10^5$<br>$0.35 \times 10^3$ (circled) $7.224 \times 10^{-6}$<br>*The circled items are in Scientific Notation because their numbers are between 1 and 10 (not bigger like 56.7 or smaller like 0.35). | |
| How to put numbers into Scientific Notation. | Examples:<br>37,498,000,000<br><br>3.7498000000.<br><br>Correct answer is<br>$3.7498 \times 10^{10}$<br><br>0.0000000492<br><br>0.00000004.92<br><br>Correct answer is<br>$4.92 \times 10^{-8}$ | 1) Move the decimal point until you have a number between 1 and 10.<br>2) Count the number of digits you moved the decimal point over. This number becomes the power of 10.<br>3) If you moved the decimal point to the right, it is a negative power (you started with a really small decimal). If you moved the decimal point to the left, it is a positive power (you started with a really large number)<br>4) Rewrite the number with the decimal point where you moved it to and multiplied by $10^n$. |
| How to change numbers from | Examples:<br>$1.45 \times 10^4$ | 1. Move the decimal point the number of digits indicated by the |

| | | |
|---|---|---|
| Scientific Notation to Standard Form. | 1.4500.<br>  <br>Correct answer is 14,500<br><br>$2.07 \times 10^{-5}$<br><br>0.00002.07<br>  <br>Correct answer is 0.0000207 | power on the 10. You may need to add some zeros.<br>2. If the power is positive, move the decimal point to the right. (This will give you a large number.) If the poser is negative, move the decimal point to the left. (This will give you a small decimal number.)<br>3. Double check that you counted the number of digit spaces to move the decimal point correctly—this is the most common mistake. |

# SCIENTIFIC NOTATION

Scientist very often deal with very small and very large numbers, which can lead to confusion when counting zeros. We have learned to express these numbers as powers.

Scientific notation takes the form of $M \times 10^n$ where $1 \leq M < 10$ and n represents the number of decimal places to be moved. Positive n indicates the standard form is a large number. Negative n indicates a number between zero and one.

Example: Convert 1,400,000 to scientific notation.

Move the decimal point so that there is only one digit to its left; a total of 6 places.

$1.4 \times 10^6$

Example: convert 0.000025 to scientific notation.

For this we move the decimal 5 places to the right and the exponent will be negative.

$2.5 \times 10^{-5}$

https://www.youtube.com/watch?v=i6lfVUp5RW8

**EXPRESS EACH OF THE FOLLOWING NUMBERS IN PROPER SCIENTIFIC NOTATION:**

1. 0.000033 = _____
2. 50,000. = _____
3. 0.000002 = _____
4. 230,000 = _____
5. 465 = _____
6. 236,000,000,000 = _____
7. 0.000000000000236 = _____
8. 48.95 = _____

EXPRESS EACH OF THE FOLLOWING AS COMMON NUMBERS:

9. $3.7 \times 10^5$ = _____

10. $3.21 \times 10^{-4}$ = _____

11. $6 \times 10^{5}$ = _____

12. $1.99 \times 10^{-3}$ = _____

13. $1.7 \times 10^{12}$ = _____

14. $8.653 \times 10^{-17}$ = _____

PERFORM EACH OF THE FOLLOWING OPERATIONS USING SCIENTIFIC NOTATION. YOUR ANSWERS SHOULD BE ROUNDED TO THE TENTHS COLUMN IN EACH ANSWER.

15. $(2.3 \times 10^{3})(4.0 \times 10^{5})$ = _____

16. $(9.6 \times 10^{-1})(5.2 \times 10^{2})$ = _____

17. $(4.56 \times 10^{-6})(3.1 \times 10^{-3})$ = _____

18. $(5.7 \times 10^{8})(2.3 \times 10^{-4})$ = _____

19. $\underline{6.7 \times 10^{2}} / 1.3 \times 10^{3}$ = _____

20. $\underline{8.1 \times 10^{4}} / 9.0 \times 10^{-3}$ = _____

21. $\underline{(1.3 \times 10^{5})(8.2 \times 10^{-2})}$ = _____

$7.4 \times 10^{2}$

22. $2.56 \times 10^{4} \underline{+ 4.6 \times 10^{3}}$ = _____

23. $8.64 \times 10^{-8} \underline{+ 2.4 \times 10^{-4}}$ = _____

24. $1.76 \times 10^{5} \underline{- 5.8 \times 10^{2}}$ = _____

25. $7.19 \times 10^{-8} \underline{- 8.9 \times 10^{-9}}$ = _____

# METRIC CONVERSION

## Metric Conversion

| King | Henry | Died | Unusually | Drinking | Chocolate | Milk |
|---|---|---|---|---|---|---|
| Kilo | Hecto | Deca | * Unit * | Deci | Centi | Milli |
|  10 x 10 x 10 x LARGER than a unit | 10 x 10 x LARGER than a unit | 10 x LARGER than a unit | ***Meter*** *(length)* ***Liter*** *(liquid volume)* ***Gram*** *(mass/weight)* **1 unit** | 10 x SMALLER than a unit | 10 x 10 x SMALLER than a unit | 10 x 10 x 10 x SMALLER than a unit  |
| 1 kilo = 1,000 units | 1 hecto = 100 units | 1 deca = 10 units | | 10 deci = 1 unit | 100 centi = 1 unit | 1,000 milli = 1 unit |
| km = kilometer<br>kL = kiloliter<br>kg = kilogram | hm = hectometer<br>hL = hectoliter<br>hg = hectogram | dam = decameter<br>daL = decaliter<br>dag = decagram | m = meter<br>L = liter<br>g = gram | dm = decimeter<br>dL = deciliter<br>dg = decigram | cm = centimeter<br>cL = centiliter<br>cg = centigram | mm = millimeter<br>mL = milliliter<br>mg = milligram |
| Example: 5 kilo | 50 hecto | 500 deca | 5,000 units | 50,000 deci | 500,000 centi | 5,000,000 milli |

DIVIDE numbers by 10 if you are getting bigger (same as moving decimal point one space to the left)

MULTIPLY numbers by 10 if you are getting smaller (same as moving decimal point one space to the right)

*Reminder* Units of measure must be alike before you can use them!

http://strongarmor.blogspot.com/2012/06/fun-with-metric-conversions.html

### EXAMPLES

1. 5 cm = _____ mm

   5 cm x $\frac{10\text{mm}}{1\text{ cm}}$ = 50 mm

2. 55 g = _____ mg

   55 g x $\frac{1000\text{ g}}{1}$ = 55,000 mg

3. 500 mL = _____ L

   500 mL x $\frac{1\text{L}}{1000\text{ mL}}$ = 0.5 L

4. 5897 mg = _____ kg

   5897 mg x $\frac{1\text{ g}}{1000\text{ mg}}$ x $\frac{1\text{ kg}}{1000\text{ g}}$ = 0.005897 kg

https://www.youtube.com/watch?v=w0nqd_HXHPQ

**Show your work and complete the problems below like the above examples.**

1. 500 g = _____ kg

2. 25 cm = _____ mm

3. 5 L = _____ mL

4. 15 km = _____ mm (HINT: this is a two-step problem!)

5. 25000 mL = _____kL (HINT: this is a two-step problem!)

6. 200 mg = _____ cg

7. 40 mL = _____ L

8. 52 g = _____ kg

9. 10 mm = _____ cm

10. 16 m = _____ km

11. 200 mg = _____ kg

12. 320 mm = _____ m

13. 4 km = _____cm

14. 23 kg = _____ g

17. 13 L = _____ mL

## Temperature and its measurement

**Temperature** (which means the average kinetic energy of the molecule) can be measured using: Celsius and Kelvin. We use the following formulas to convert form one scale to another. Celsius is the scale most desirable for laboratory work. Kelvin represents the absolute scale.

$$°C = K - 273 \qquad K = °C + 273$$

Complete the following chart. All measurements are good to 1° C or better.

| | ° C | K |
|---|---|---|
| 1 | **0° C** | |
| 2 | 30°C | |
| 3 | | **450 K** |
| 4 | | 0°K |
| 5 | **-273° C** | |
| 6 | | **294 K** |
| 7 | <150°C | |
| 8 | | **225 K** |
| 9 | **-40 ° C** | |

**Element names, symbols and classification**

1. Memorize all of the following symbols and correctly spelled elements below.
2. Classify each element as metal (M), transition metal (TM), semimetal (SM), or nonmetal (NM).

| Name | Symbol | M, TM, SM or NM | | Name | Symbol | M, TM, SM or NM |
|---|---|---|---|---|---|---|
| aluminum | Al | | | lithium | Li | |
| antimony | Sb | | | magnesium | Mg | |
| argon | Ar | | | manganese | Mn | |
| arsenic | As | | | mercury | Hg | |
| barium | Ba | | | neon | Ne | |
| beryllium | Be | | | nickel | Ni | |
| boron | B | | | nitrogen | N | |
| bromine | Br | | | oxygen | O | |
| calcium | Ca | | | palladium | Pd | |
| carbon | C | | | phosphorus | P | |
| cesium | Cs | | | platinum | Pt | |
| chlorine | Cl | | | potassium | K | |
| chromium | Cr | | | radon | Rn | |
| cobalt | Co | | | silicon | Si | |
| copper | Cu | | | silver | Ag | |
| fluorine | F | | | sodium | Na | |
| gold | Au | | | strontium | Sr | |
| helium | He | | | sulfur | S | |
| hydrogen | H | | | tin | Sn | |
| iodine | I | | | titanium | Ti | |
| iron | Fe | | | uranium | U | |
| krypton | Kr | | | xenon | Xe | |
| lead | Pb | | | zinc | Zn | |

Only the first letter of the symbol is a capital letter. If there is a second letter, it MUST be lowercase, ex. Sn. It can't be a small capital letter, ex. SN

SPELLING COUNTS!

Generally speaking....Where do the metals occur on the periodic table? _____

Where do you find the nonmetals? _____

## Student Reading Resources:

Student reading on Density by Day and Capri:

http://www.visionlearning.com/library/module_viewer.php?mid=37

*Student Reading: Absolute Zero*

http://physics-history.suite101.com/article.cfm/absolute_zero

*Student Reading: Matter: States of Matter by Day and Capri*

http://www.visionlearning.com/library/module_viewer.php?mid=120

*Student Resource: Heating Cooling Curve*

http://www.kentchemistry.com/links/Matter/HeatingCurve.htm

## Review Eureka! videos 16-21

https://www.youtube.com/watch?v=4TPV3V39PMI&list=PLDkFaBQniy-FHJETes8dmio_CCmH0xEuO

## Writing Formulas

Chemical formulas are written with rules according to the type of molecule they form.

USE A PERIODIC TABLE TO CHECK FOR **METALS AND NONMETALS!!** **Metals** are found on the left side of the stair step (BOLD) line on the periodic table. **Nonmetals** are found on the right side of the stair step line of the periodic table. **Metalloids** are the elements found along side of the stair step line and include: Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium, Polonium, and Astatine.

### A. Writing formulas for compounds.

I. **Writing basic ionic compound formulas.**

a. Ionic compounds: usually contain a **metal** and a **nonmetal.**

b. Write the symbol and **oxidation number** for the element.

c. The **metal** (positive ion) is always written first then followed by the **nonmetal.**

https://www.youtube.com/watch?v=URc75hoKGLY

d. Drop the + or – sign and cross the number to the opposite element to become a subscript.

e. If it is a **transition metal**, the Roman numeral is the value of the positive charge.

f. Notice the **-ide** ending. This tells you that it is a single element, not a polyatomic ion.

Examples: lithium sul**fide** $Li^{+1}$ $S^{-2}$ => $Li_2S$ copper (II) brom**ide** $Cu^{+2}$ $Br^{-1}$ => $CuBr_2$

**Oxidation numbers:** the positive or negative number assigned to an atom to indicate its degree of oxidation or reduction. All atoms want be stable with valence (outermost) electrons = 8 or oxidation # =0.

**a.** **Nonmetals** will gain enough electrons to reach a total of 8. Gaining electrons will give an ion a negative charge a value of the number of electrons needed to reach 8.

**b.** **Metals** will usually lose their valence electrons to get back to zero. They will then have more protons than electrons having a positive oxidation number with the value being the number of electrons the atom will lose.

| Group Number | # of valence electrons | Gain or lose and number | Oxidation number |
|---|---|---|---|
| 1A | 1 | Lose 1 | +1 |
| 2A | 2 | Lose 2 | +2 |
| 3A | 3 | Lose 3 | +3 |
| 4A | 4 | Gain or lose 4 | +/-4 |
| 5A | 5 | Gain 3 | -3 |
| 6A | 6 | Gain 2 | -2 |
| 7A | 7 | Gain 1 | -1 |
| 8A | 8 | Stable | 0 |

### Using Polyatomic Ions in ionic compounds.

a. Each polyatomic ion is a complete unit, **NEVER** break it up or change the numbers.

b. Use charges just like with regular ionic compounds.

c. Most end in **-ate** and **-ite**, only a few (cyanide, hydroxide) have an -ide ending.

https://www.youtube.com/watch?v=p9iQ5Qn42DM

**Common polyatomic ions:**

| | |
|---|---|
| Ammonium | $NH_4^{+1}$ |
| Phosphate | $PO_4^{-3}$ |
| Phosphite | $PO_3^{-3}$ |
| Hydroxide | $OH^{-1}$ |
| Chlorate | $ClO_3^{-1}$ |
| Sulfate | $SO_4^{-2}$ |
| Sulfite | $SO_3^{-2}$ |
| Carbonate | $CO_3^{-2}$ |

Examples: lithium sulfate $Li^{+1}$ $SO4^{-2}$ => $Li_2SO_4$
copper (II) nitrite $Cu^{+2}$ $NO_3^{-1}$ => $Cu(NO_3)_2$. Notice the ( ), use these when you have more than one polyatomic ion.

II. **Writing formulas for molecular compounds. (COVALENT)**
   a. Molecular compounds: **nonmetals only!**
   b. DO NOT USE CHARGES!!!
   c. Prefixes give the number of each element.

Examples: $CO_2$ carbon **di**oxide, notice the ending change. The **di** means two of that element, in this case oxygen. Dinitrogen monoxide = $N_2O$, dichlorine heptoxide = $Cl_2O_7$

https://www.youtube.com/watch?v=DeJkvR4pvRw

The prefixes are:

| | | | | |
|---|---|---|---|---|
| 1 - mono | 2 - di | 3 - tri | 4 - tetra | 5 - penta |
| 6 - hexa | 7 - hepta | 8 - octa | 9 - nona | 10 - deca |

**IONIC**

1: potassium oxide _____

2: beryllium iodide _____

3: lead(IV)oxide _____

4: magnesium nitride _____

5: calcium bromide _____

6: sodium phosphate _____

7: aluminum sulfate _____

8: ammonium hydroxide _____

9: lithium oxide _____

10: strontium chlorate _____

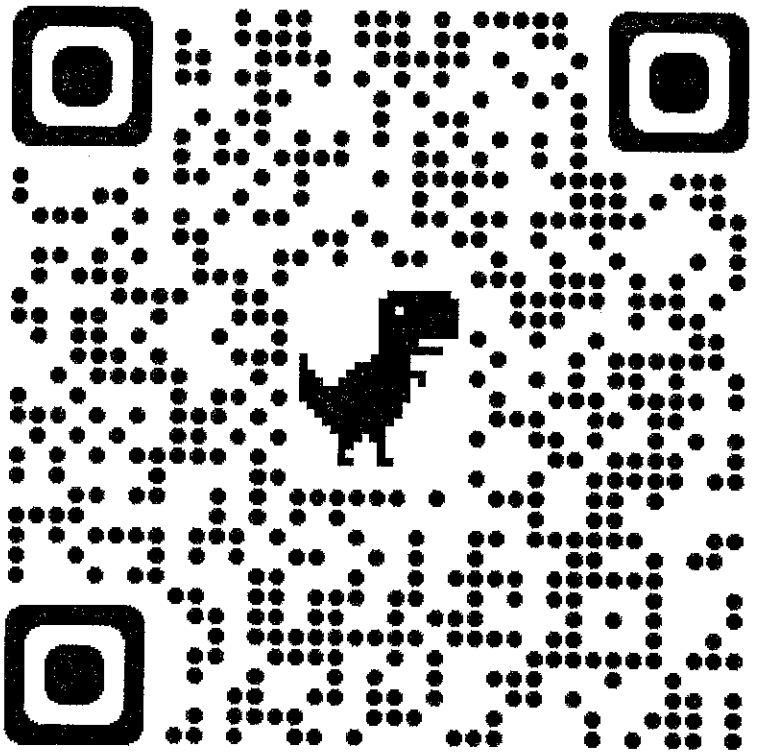
**COVALENT**

1. carbon dioxide _____
2. carbon monoxide _____
3. silicon tetrachloride _____
4. dinitrogen monoxide _____
5. dinitrogen pentaoxide _____
6. phosphorus trichloride _____
7. chlorine gas _____
8. sulfur dichloride _____
9. diphosphorus trioxide _____
10. dihydrogen monoxide _____

## More Practice Problems

Decide if the compound is ionic or covalent. Then write the formula on the line provided.

| | | Ionic/Covalent |
|---|---|---|
| 1. | sodium chloride _____ | _____ |
| 2. | carbon tetrachloride _____ | _____ |
| 3. | magnesium bromide _____ | _____ |
| 4. | phosphorus trichloride _____ | _____ |
| 5. | hydrogen hydroxide _____ | _____ |
| 6. | Iron (II) fluoride _____ | _____ |
| 7. | sodium carbonate _____ | _____ |
| 8. | ammonium sulfide _____ | _____ |
| 9. | Iron (II) oxide _____ | _____ |
| 10. | Iron (III) oxide _____ | _____ |
| 11. | magnesium sulfate _____ | _____ |
| 12. | sodium phosphate _____ | _____ |
| 13. | dinitrogen pentaoxide _____ | _____ |
| 14. | aluminum iodide _____ | _____ |
| 15. | aluminum sulfite _____ | _____ |
| 16. | copper (I) carbonate _____ | _____ |
| 17. | sulfur trioxide _____ | _____ |
| 18. | Barium hydroxide _____ | _____ |



https://www.youtube.com/watch?v=dRfrvpVdKGM

Tyler Dewitt has multiple videos that can be extremely helpful when learning (or trying to remember) chemistry. If you have see that you are having trouble understanding or remembering any of the concepts in this summer assignment, check to see if he has a video that may help you.

# Atomic Structure Worksheet

Atoms are made up of protons, electrons and neutrons. The atomic number of an element is equal to the number of protons it contains. The mass number is equal to the number or protons plus the number of neutrons. In a neutral atom, the number of protons and the number of electrons are equal. Ion charges indicate an imbalance between the number of protons and the number of electrons. More electrons produce a negative charge and more protons create a positive charge. Using this information fill out the following chart.

| Name | Symbol | Atomic # | Mass Number | #of Protons | #of Neutrons | #of Electrons | Charge |
|---|---|---|---|---|---|---|---|
| Titanium | Ti | 22 | | | 26 | 22 | |
| | C | | | | | | 0 |
| Sulfur | | | | 16 | 16 | 18 | |
| | Ba | 56 | | | | | +2 |
| Phosphorus | | | 31 | 15 | | | -3 |
| | Fe | | | | | 23 | |
| | Ag | | 108 | 47 | | 46 | |
| Hydrogen-3 | | 1 | | | | | 0 |
| Lithium | | 3 | | | 4 | | +1 |
| | O | | 18 | 8 | | 8 | 0 |
| | He | 2 | 4 | | | | 0 |
| Nitrogen | | | 14 | | | | 0 |
| | K | | 39 | 19 | | | 0 |
| Bromine | | | | 35 | 45 | 36 | |
| Oxygen | | 8 | 16 | | | 6 | +2 |
| | Al | 13 | 27 | | | 13 | 0 |
| | Mg | | | | | | +2 |
| Arsenic | | 33 | 75 | | | | -3 |
| | Cl | | 35 | | | | -1 |

# Part 2 - Chemistry Concepts

## Learning Targets

Solids, liquids and gases

- Distinguish between observable differences in properties of the states of matter based on particle behavior, (arrangement, attraction between particles and particle movement)

Use differences in observable properties to distinguish between elements, compounds and mixtures.

- Connect the observable properties (macroscopic) to the particle behavior (microscopic).

Use particle level representations to model these differences.

Distinguish between a pure substance and a mixture by:

- properties
- separation techniques
- composition (macro- and microscopically)

Describe how one could use differences in characteristic/intensive properties to separate the components of a mixture.

- identify the separation technique (name, equipment)
- identify the property used in the separation

Learn the names and symbols for common elements

- Identify given groups on the periodic table
- Identify location of metals, nonmetals and semimetals (metalloids) on periodic table

# Matter

**Matter: All matter has mass and takes up space. It is made of particles.**

| Classification of Matter | |
|---|---|
| **Pure Substance:** All particles of the substance are identical.<br>• Elements: Simplest type of substance with unique characteristic/intensive properties<br>• Compounds: Formed when 2 or more elements chemically combine to form new substance with new characteristic/int properties. | **Mixture:** Contains two or more types of particles that each retain their characteristic properties.<br>• Heterogenous<br>• Homogenous |

| **Element** | **Compound** | **Heterogeneous** | **Homogeneous** |
|---|---|---|---|
| All of the particles are the same atom. These can be found on the periodic table. | Not all of the particles are the same atom. Molecule (made from more than one element on the periodic table) | You can see the different components of the mixture | You cannot see the different components – also called solution or alloy |
| Ex:<br><br>Atoms of an element<br>  <br><br>Molecules of an element<br>  | Ex:<br><br>Molecules of a compound<br>  | Ex:<br><br>Cannot be represented at the particle level | Ex:<br><br>A mixture of an element and compound<br>  <br><br>This could be a mixture of elements, compounds or both |

**Matter**

**Gas**
Particles are independent, widely separated, with no attractive forces between them. them. They fill the volume of the container.

**Liquid**
Particles constantly make and break temporary attractions between each other. Particles can slip past one another easily. easily. They take the shape of the container.

**Solid**
Strong attractions between particles lock them into a fixed fixed arrangement.

**Pure Substances**
These have fixed compositions, one set of intrinsic physical properties (density, mp, bp), bp), and cannot be separated by physical physical means. At microscopic level, all particles are identical.

**Mixtures**
These have variable composition. Their physical properties vary depending on the the composition. They can be separated by separated by physical means. At microscopic level, there are more than one one type of particles.

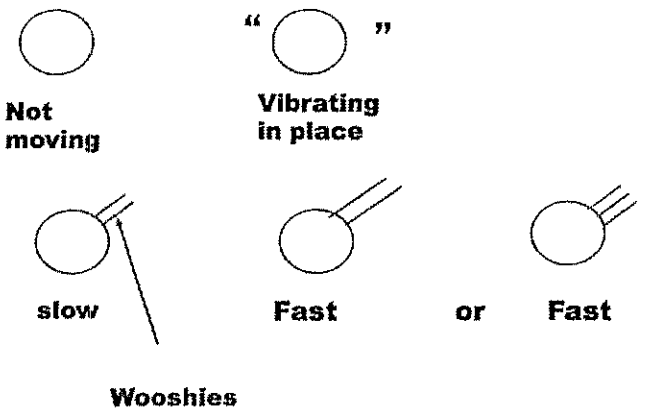
**Elements**
These cannot be broken down into into simpler substances by physical physical or chemical means. The smallest particle of this is called an atom. (Particles of 7 of these are diatomic molecules.)

**Compounds**
These are made of elements in fixed fixed mass ratios. They can be broken down into simper substances substances by chemical means. Fixed mass ratio indicates that atoms are combined in small whole whole number ratios.

**Homogeneous**
Exists in one phase only and has uniform properties throughout the sample.

**Heterogeneous**
May exist in more than one phase phase and have variable properties properties in different parts of the sample

## How to Represent Particle Movement:




## Particle Representation - States of Matter

Complete the following table:

| | Solid | Liquid | Gas |
|---|---|---|---|
| **Particle diagram**<br><br>Draw a representation of each state of matter for a pure substance: include details regarding density, arrangement, and movement | | | |
| **Describe movement of particles** | | | |
| **Describe particle Arrangement** | | | |
| **Describe attraction between particles** | | | |
| **Shape and Volume** | | | |
| **Density** | | | |
| **Compressibility** | | | |

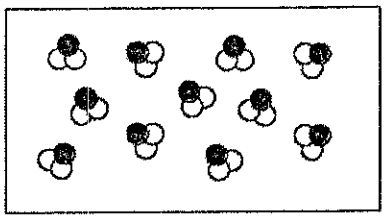
 See Page #18 for diagram explanation

**Describing Substances,Elements, Compounds, and Mixtures**

Classify each of the pictures below by placing the correct label in the blanks below:

A= Element
B= Compound
C= Mixture of elements
D= Mixture of compounds
E= Mixture of elements and compounds

Each circle represents a particle of an element and each different color represents a different kind of element. If two circles are touching then they are a compound.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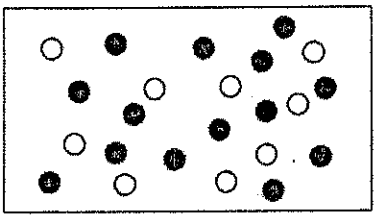
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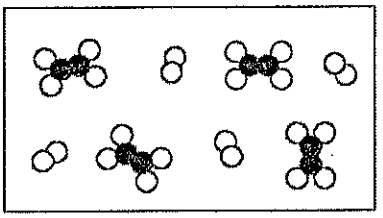
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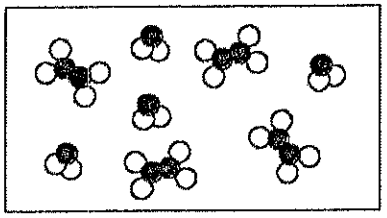
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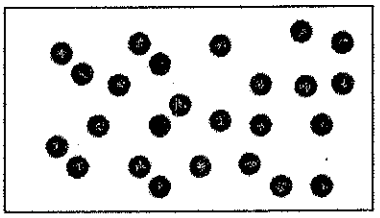
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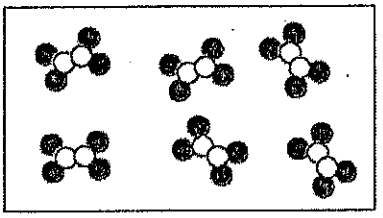
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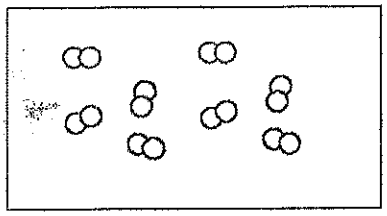
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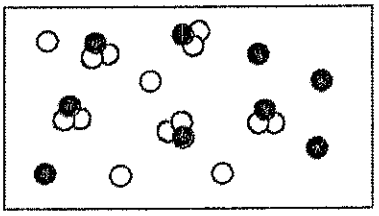
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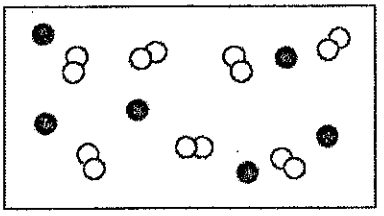
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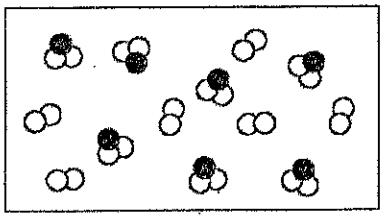
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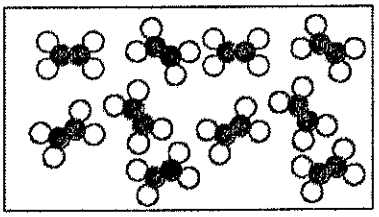
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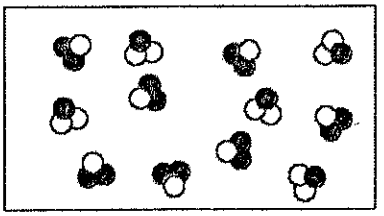
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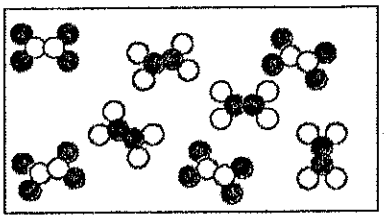
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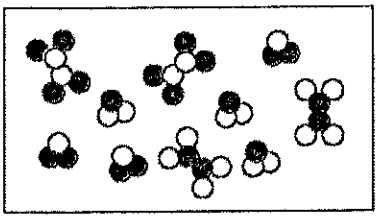
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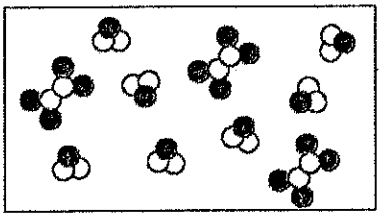
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