

## Chemistry Review

### Lab safety and equipment:

Know:

- How to handle chemicals and laboratory equipment safely.
- Basic laboratory equipment

### Sig Figs and Metric Conversions

#### Significant Figures

How many significant figures are in the following measurements?

0.012 g 2      1,003 mL 4      0.12300 g 5

$7.54 \times 10^{-3}$  m 3      5,000 cm<sup>3</sup> 1      5,000.00 nm 6

#### Convert from one metric unit to another metric unit

100 meters = 1000 cm

230 mL = .23 Liters

0.062 kilograms = 62000 mg

7 cm = 0.00007 km

### Matter

What is matter composed of?

Define matter.

Matter is anything that has mass and takes up space.

Define each of the following.

mass: amount of matter

volume: amount of space matter takes up

length: how long something is

temperature: the amount of heat energy something has

### Density

Define density.

Mass per unit volume  $D=m/v$

Calculate density. If a given object has a mass 100.0 g and a volume of 25.0 mL. What is this object's density?

4.00 g/mL

Given the following 3 rings:



Ring 1

Ring 2

Ring 3

And given that each ring is made out of pure gold, answer the following questions:

What can you say about the relationship between the mass and volume as you compare the 3 rings? **Mass and volume both increase as the rings increase**

Which ring would have the greatest mass?

**Ring 1 would have the greatest mass**

Which ring would have the greatest density?

**All the densities will be the same since it is made of the same material**

**How can we classify matter based on its composition?**

Matter can be classified into what 3 states?

- Solids
- Liquids
- Gases

Which 2 categories are composed of more than one type of substance?

**Mixtures and compounds**

Which category has a chemical formula? **compounds**

Which category can be found on the periodic table? **elements**

Which category can be separated? **Mixtures - heterogeneous can separate easily**

Illustrate, describe and label the 2 types of mixtures.

<b>Homogeneous - uniform throughout, constant composition, unable to see the individual pieces, VERY difficult to separate</b>	<b>Heterogeneous - is NOT uniform throughout, parts are easily identified, able to be separated</b>
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## How do physical properties compare with chemical properties of substances?

Complete the chart on chemical properties.

<b>Chemical Properties (Define/Explain)</b>	
Properties that can only be observed when there is a change in the composition of a substance	
<b>Ability to <u>Burn</u></b> <ul style="list-style-type: none"><li>A chemical process that takes place when a substance reacts with oxygen quickly and releases heat and light energy.</li></ul>	<b>Ability to <u>Rust</u></b> <ul style="list-style-type: none"><li>A chemical process that takes place when a substance reacts with oxygen and water slowly</li></ul>

Complete the chart on physical properties.

<b>Physical Properties (Define/Explain)</b>			
Characteristics of matter that can be measured and observed without changing the makeup of the substance.			
<b><u>Melting Point</u></b> <ul style="list-style-type: none"><li>Temperature at which a substance changes from a solid to a liquid</li></ul>	<b><u>Boiling Point</u></b> <ul style="list-style-type: none"><li>Temperature at which a substance changes from a liquid to a gas</li></ul>	<b><u>Density</u></b> <ul style="list-style-type: none"><li>The measure of an object's mass compared to volume: heaviness compared to size/volume</li></ul>	<b><u>Color</u></b> <ul style="list-style-type: none"><li>The color of an object or absence of color</li></ul>

## How do physical and chemical changes of substances compare?

Explain what a physical change is.

A change in which the appearance or state of matter changes but the substance's properties and makeup remain the same.

What are two types of evidences that a physical change occurred?

- Change in size or shape
- Change in state of matter

Explain what a chemical change is.

A chemical change is when one or more substances combine or break apart to form new substances.

What are the four types of evidences that a chemical change occurred?

- Change in color
- Change in temperature
- Formation of a gas
- Formation of a precipitate

Complete the chart explaining the evidences of chemical and physical changes.

Evidence of Change	Explanation	Physical or Chemical?
Change in size/shape	The matter changes size or shape without changing substance composition. Example: Tearing a sheet of paper	Physical
Formation of a Gas	A gas is formed when 2 or more substances are combined. It may be shown by bubbling or fizzing. Example: mixing baking soda/vinegar	Chemical
Change in state of matter	The matter changes from a solid to liquid, liquid to gas or vice versa without changing composition of substance. Example: ice melting	Physical
Formation of a Precipitate	A solid is formed when 2 or more substances are combined. Example: Chalk is formed when carbon dioxide and limewater are combined	Chemical
Change of Color	Substance changes color over time. Example: newspaper yellowing	Chemical
Change in Temperature	When 2 or more substances mix, a change in temperature is noted. Example: hot hands that hunters use	Chemical

Classify the following as physical or chemical changes:

- spoiling of milk **chemical**
- bending wire **physical**
- cutting paper **physical**
- rusting of a nail **chemical**



## Atoms

List 3 facts about ATOMS.

- Atoms are the smallest particles of matter.
- Atoms are the building blocks of matter.
- Atoms cannot be broken down any smaller. They are as small as it gets.

### Atomic Models:

Scientists: What was the contribution of each one's atomic model? Draw a model of each.

- **John Dalton**

List the four postulates of Dalton's Atomic Theory:

- **J.J. Thompson**

- **Ernest Rutherford**

- **Niels Bohr**

### Characteristics of subatomic particles

Particle	Charge	Location in atom
Proton		
Neutron		
Electron		

## Atoms and Ions

How do atoms and ions differ?

Fill out the chart on atoms and ions

Element	# of protons	# of neutrons	# of electrons	Atomic number	Mass number	Atom or Ion?
	26				56	
Iodine					127	Atom
	16		18		32	

Define the term *isotope*.

Fill in the following for this Carbon-14 isotope,  $^{14}_6\text{C}$

- Atomic number = \_\_\_\_\_ Mass number = \_\_\_\_\_
- # of protons = \_\_\_\_\_ # of electrons = \_\_\_\_\_ # of neutrons = \_\_\_\_\_

Atomic Masses: What is the difference between the mass number for Carbon-14 and carbon's atomic mass of 12.011 amu?

## The Periodic Table

How is the periodic table organized?

What are the rows going across called? periods

The groups/families are the columns going up and down.

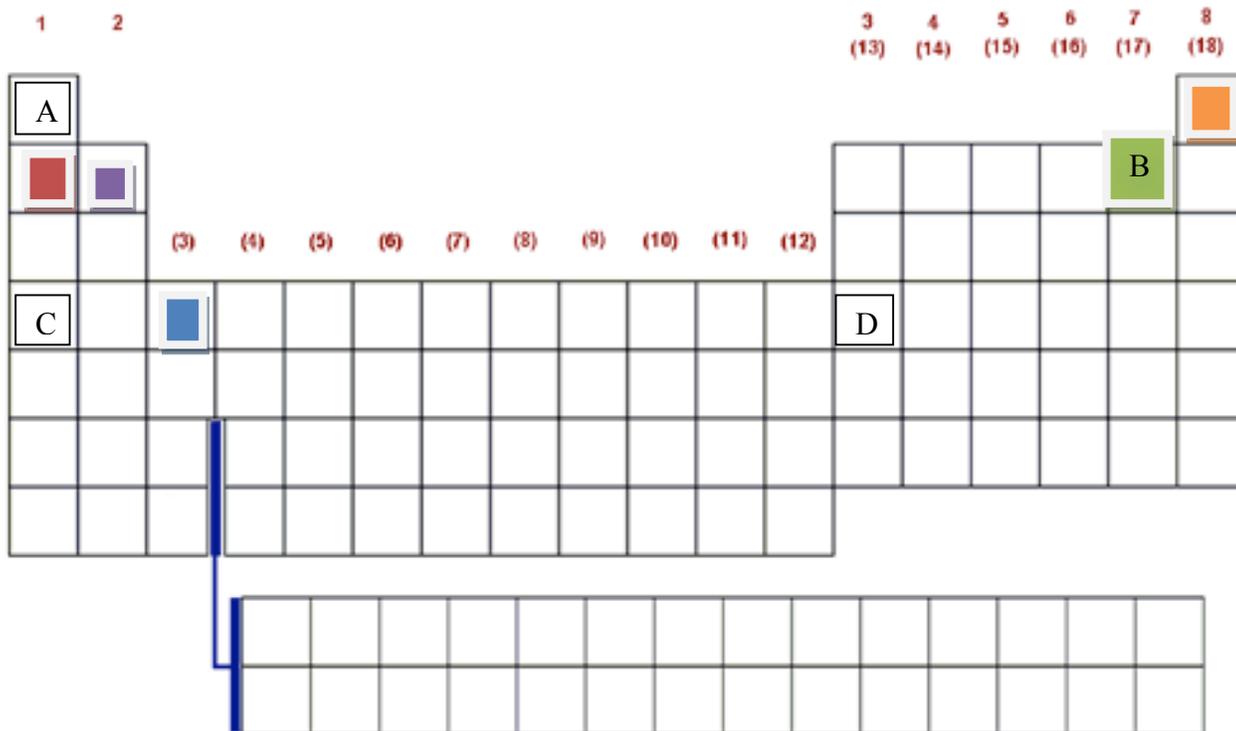
A chemical symbol uses a capital letter followed by a lowercase (in some cases) to represent each element.

Complete the following table with the correct information.

ELEMENT	SYMBOL	ATOMIC #	FAMILY	PERIOD	METAL OR NONMETAL
Oxygen	O	8	16	2	Non-metal
Sodium	Na	11	1	3	Metal
Carbon	C	6	14	2	Non-metal
Hydrogen	H	1	1	1	Non-metal
Chlorine	Cl	17	17	3	Non-metal
Nitrogen	N	7	15	2	Non-metal

Locate or define parts of the periodic table:

- Transition metals vs. Representative Elements
- Alkali metals, Alkaline Earth metals, Halogens, Noble Gases



On the table above

1. Label the A groups (i.e. IA, IIA, IIIA, etc.)
2. Label the Alkali Metal family. This is also known as group \_\_\_\_\_. All elements in this family have \_\_\_\_\_ valence electron. These elements form an ion with a \_\_\_\_\_ charge.
3. Label the Alkaline-Earth Metal family. This is also known as group \_\_\_\_\_. All elements in this family have \_\_\_\_\_ valence electrons. These elements form an ion with a \_\_\_\_\_ charge.

4. Color the transition metals blue.

5. Label the Halogen family. This is also known as group \_\_\_\_\_. All elements in this family have \_\_\_\_\_ valence electrons. These elements form an ion with a \_\_\_\_\_ charge.

6. Label the Noble Gas family. This is also known as group \_\_\_\_\_. All elements in this family have \_\_\_\_\_ valence electrons.

## Periodic Trends

Periodic Trends: Increasing or Decreasing from top to bottom or left to right?

	Top to Bottom in a Group	Left to Right across a Period
Electronegativity		
Ionization energy		
Atomic size		

Using the periodic table on page 10 of this study guide, answer the following questions:

1. Which element stands alone in its family? \_\_\_\_\_
2. Which element has a larger atomic radius A or C? \_\_\_\_\_
3. Which element has a larger atomic radius C or D? \_\_\_\_\_
4. Which element has a higher electronegativity? A or B? \_\_\_\_\_
5. Which element has a higher ionization energy? C or D? \_\_\_\_\_

Elements in the same \_\_\_\_\_ (group, period) have similar physical and chemical characteristics because they have the same number of \_\_\_\_\_ (atoms, protons, neutrons, electrons, valence electrons).

Draw an electron dot diagram (or Lewis Dot structure) for Be and for N showing the correct number of valence electrons.

From their positions on the periodic table, what charges would the ions of Be and N have?

	Gains or loses electrons?	Symbol for ion		Gains or loses electrons?	Symbol for ion
Be			N		

How do the physical properties of metals and nonmetals differ?

PHYSICAL PROPERTIES can be measured or observed \_\_\_\_\_ changing the substance.

Complete the table for each property.

PROPERTY	ILLUSTRATION/DESCRIPTION	METAL OR NONMETAL?
Ductile	Able to be shaped/drawn into a wire	Metal
Luster	Shiny, reflects light	Metal
Malleable	Able to be hammered in to shapes	Metal
Conductivity	Transmits/transport electricity/energy/heat	Metal
Brittle	Easy to break, breaks in to smaller pieces	Non-metal
High Density	Heavy for its' size	Metal

## Naming Molecular and Ionic Compounds

What do chemical formulas represent?

Write the common name for each of the following chemical formulas.

H<sub>2</sub>O \_\_\_\_\_ C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> \_\_\_\_\_ O<sub>2</sub> \_\_\_\_\_  
 NaCl \_\_\_\_\_ CO<sub>2</sub> \_\_\_\_\_ N<sub>2</sub> \_\_\_\_\_

Tell how many atoms of each element are present in the chemical formulas.

- H<sub>2</sub>O<sub>2</sub>
- HClO<sub>4</sub>

## Naming molecular compounds

Name:  $N_2O$ : \_\_\_\_\_ and  $NO_2$  \_\_\_\_\_

## Naming Ionic Compounds

Name:  $Li_2O$  \_\_\_\_\_ and  $(NH_4)_2SO_4$  \_\_\_\_\_

Name:  $FeO$  \_\_\_\_\_ and  $Sn_3(PO_4)_4$  \_\_\_\_\_

Name:  $NaHCO_3$  \_\_\_\_\_ and  $CuCl_2$  \_\_\_\_\_

## Formulas of Molecular and Ionic Compounds

Write formulas for the following compounds:

Water \_\_\_\_\_ silicon dioxide \_\_\_\_\_

Phosphorous trihydride \_\_\_\_\_ dioxygen difluoride \_\_\_\_\_

Lead (II) hydroxide \_\_\_\_\_ chromium (III) sulfate \_\_\_\_\_

Write formulas for the following ionic compounds:

$Ba^{2+}$  with  $OH^-$  \_\_\_\_\_ iron (III) sulfide \_\_\_\_\_

$Na^+$  with  $OH^-$  \_\_\_\_\_  $NH_4^+$  with  $PO_4^{3-}$  \_\_\_\_\_

magnesium oxide \_\_\_\_\_

## The Mole and Percent Composition

### Mole Conversions

SOLVE THE FOLLOWING MOLAR CONVERSION PROBLEMS:

1. How many grams would  $8.1 \times 10^{21}$  molecules of sucrose ( $C_{12}H_{22}O_{11}$ ) weigh?
2. How many moles are in 53.8 g of magnesium chloride?
3. How many atom are in 0.845 moles of  $NaNO_3$ ?
4. How many molecules are in 50.0 g of calcium sulfide?

5. How many atoms are in a 2.0 kg nugget of gold? (Note mass units.)

### Percent Composition

SOLVE THE FOLLOWING PERCENTAGE COMPOSITION PROBLEMS:

6. Find the percentage composition of sucrose ( $C_{12}H_{22}O_{11}$ ).
7. Find the percentage composition of a sample containing 1.29 g of carbon and 1.71 g of oxygen.
8. Find the mass percentage of sodium in sodium carbonate.

### Empirical Formula

SOLVE THE FOLLOWING EMPIRICAL FORMULA PROBLEMS:

9. Find the empirical formula of a compound that contains 75% carbon and 25% hydrogen.
10. Find the empirical formula of a compound that contains 9.03 g magnesium and 3.48 g of nitrogen.
11. The empirical formula of a compound is  $NO_2$ . Its molecular mass is 92 g/mol.
12. A compound is composed of 34.2% sodium, 17.7% carbon, and 47.6% oxygen. Find its empirical formula.