Matter and Chemical Change
Topic 1

Name _____

Elements, Compounds & Mixtures Worksheet

Part 1: Read the following information on elements, compounds and mixtures. Fill in the blanks where necessary.

Elements:

- A pure substance containing only one kind of _____.
- An element is always uniform all the way through (homogeneous).
- An element _____ be separated into simpler materials (except during nuclear reactions).
- Over 100 existing elements are listed and classified on the _____.

Compounds:

- A pure substance containing two or more kinds of _____.
- The atoms are _____ combined in some way. Often times (but not always) they come together to form groups of atoms called molecules.
- A compound is always homogeneous (uniform).
- Compounds _____ be separated by physical means. Separating a compound requires a chemical reaction.
- The properties of a compound are usually different than the properties of the elements it contains.

Mixtures:

- Two or more _____ or _____ NOT chemically combined.
- No reaction between substances.
- Mixtures can be uniform (called _____) and are known as solutions.
- Mixtures can also be non-uniform (called _____).
- Mixtures can be separated into their components by chemical or physical means.

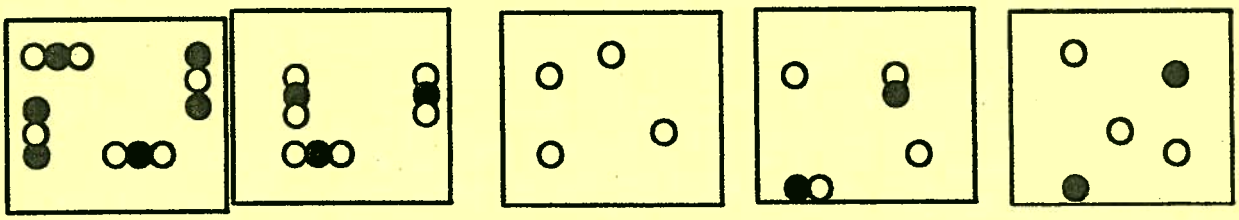
Part 2: Classify each of the following as elements (E), compounds (C) or Mixtures (M). Write the letter X if it is none of these.

___Diamond (C)	___Sugar ($C_6H_{12}O_6$)	___Milk	___Iron (Fe)
___Air	___Sulfuric Acid (H_2SO_4)	___Gasoline	___Electricity
___Krypton (K)	___Bismuth (Bi)	___Uranium (U)	___Popcorn
___Water (H_2O)	___Alcohol (CH_3OH)	___Pail of Garbage	___A dog
___Ammonia (NH_3)	___Salt (NaCl)	___Energy	___Gold (Au)
___Wood	___Bronze	___Ink	___Pizza

Part 3: Match each diagram with its correct description. Diagrams wil be used once.

Matter and Chemical Change
Topic 1

Name _____



___1. Pure Element – only one type of atom present.

___2. Mixture of two elements – two types of uncombined atoms present.

___3. Pure compound – only one type of compound present.

___4. Mixture of two compounds – two types of compounds present.

___5. Mixture of a compound and an element.

Part 4: Column A lists a substance. In Column B, list whether the substance is an element (E), a compound (C), a Heterogeneous Mixture (HM), or a Homogenous (S). (Remember a solution is a homogeneous mixture.) In Column C, list TWO physical properties of the substance.

Column A	Element, Compound, Heterogeneous or Homogeneous
1. Summer Sausage	
2. Steam	
3. Salt Water	
4. Pencil lead (Pb)	
5. Dirt	
6. Pepsi	
7. Silver (Ag)	
8. Toothpaste (Na_2HPO_4)	
9. A burrito	

Topic 2

Changes in Matter

Matter can change from one form to another, or create new materials. Every kind of matter has its own distinguishing characteristic properties that can be used to identify the kind of matter it is. PROPERTIES are characteristics that can be used to describe how a substance behaves with another substance. This properties can be PHYSICAL or CHEMICAL

Changes in matter can fall into two classification categories: physical change and chemical change.

A PHYSICAL CHANGE occurs when a material changes form but not composition. A change of state is an example of a physical change where energy is used or released. No new substances are formed. The change the is not permanent. DISSOLVING IS ALSO A PHYSICAL CHANGE.

A CHEMICAL CHANGE occurs when two or more substances react and create one or more NEW SUBSTANCES. It if often permanent, although not always. Combustion is an example. How do you know if a chemical change has occurred? Well, the following could be indicators:

- Change in colour
- Change in odour
- Formation of a gas (bubbles) in a liquid
- Foramtion of a solid (percipitate) in a liquid
- Release or absorption of energy (heat)
- Materials you started with are used up
- A new material is formed
- The change is difficult to reverse

The only evidence that will guarantee a chemical change has occurred is that a NEW SUBSTANCE HAS BEEN FORMED.

<u>Properties: Chemical or Physical?</u>
Any property that can be observed without forming a new substance is a physical property (see next page).

Any property that describes how a substance reacts with another substance when forming a new substance is a chemical proerty. Chemical properies include:

- Reaction with acids
- Combustibility (ability to burn)
- Reaction with water
- Behaviour in air
- Reaction to heat
- Toxicity
- Stability

SOME PHYSICAL PROPERTIES OF MATTER

Melting point	The melting point of a substance is the temperature at which it changes from a solid to a liquid. The melting point of ice is 0 °C. At this temperature, it changes into water. Other substances have different melting points. For example, table salt melts at 801 °C, and propane melts at −190 °C.
Boiling point	The boiling point of a substance is the temperature at which its liquid phase changes to the gas phase. At sea level, water's boiling point is 100 °C. Table salt boils at 1413 °C, and propane boils at −42 °C.
Hardness	Hardness is a substance's ability to resist being scratched. Hardness is usually measured on the Mohs' hardness scale from 1 to 10. The mineral talc is the softest substance on the scale (1). Diamond is the hardest (10). Figure 1.7 shows the scale.
Malleability	A substance that can be pounded or rolled into sheets is said to be **malleable**. Metals such as gold and tin are malleable. Aluminum foil is an example of a product made from a malleable substance.
Ductility	Any solid that can be stretched into a long wire is said to be **ductile**. The most common example of a ductile material is copper.
Crystal shape	The shape of a substance's crystals can help identify it. Silicon crystals, for example, are diamond shaped. Salt crystals form cubes.
Solubility	**Solubility** is the ability of a substance to be dissolved in another. For example, sugar is soluble in water, but cooking oil is not.
Density	**Density** is the amount of mass in a given volume of a substance. The density of water is 1 g/mL. The density of gold is 19 g/cm^3.
Conductivity	**Conductivity** is the ability of a substance to conduct electricity or heat. A substance that conducts electricity or heat is called a conductor. A substance with little or no conductivity is an insulator.

SOME EVIDENCE OF CHEMICAL CHANGES

Evidence of Chemical Change	Example
Change in colour	When bleach is added to the dye on a denim jacket, a noticeable colour change occurs.
Change in odour	When a match is struck, the substances in the match head react and give off a distinctive odour.
Formation of a solid or gas	When vinegar (a liquid) is added to baking soda (a solid), carbon dioxide gas is formed.
Release or absorption of heat energy	When gasoline burns in a car engine, heat is released.

Name: _____ Date: _____

Physical and Chemical Change Worksheet

True or False. If false, correct the underlined portion of the statement so that it is true.

1. A physical change is a change of matter from one form to another without a change in chemical properties.

2. A physical change is a change that occurs when a substance changes composition by forming one or more new substances.

3. Color change is evidence that a chemical change may have occurred.

4. Fizzing or foaming is evidence that a chemical change may have occurred.

5. Production of light is evidence that a physical change may have occurred.

6. Production of heat or light is evidence that a chemical change may have occurred.

7. A change in odor is evidence that a physical change may have occurred.

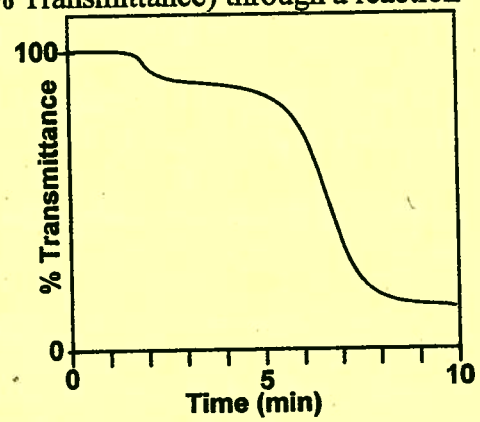
8. Chemical changes can be reversed by physical changes.

Identify each of the following as either a Physical change (P) or a chemical change (C).

1. You cut your hair. _____
2. Making a peanut, pretzel and cereal mixture. _____
3. Baking soda reacts with vinegar and forms a gas. _____
4. A piece of metal is bent in half. _____
5. An aspirin is crushed into fine powder. _____
6. Copper turns green when exposed to the environment. _____
7. Two clear liquids are mixed and a yellow color forms. _____
8. Baking cookies. _____
9. Diamonds are used to scratch glass. _____
10. A tree burns to form ashes. _____
11. A piece of paper is crumpled up. _____
12. Water freezes to form ice. _____
13. Food spoiling. _____
14. A candle burning. _____
15. A candle melting. _____

Analyzing Graphs

The graph at the right plots the amount of light transmitted (% Transmittance) through a reaction flask as a function of time. Initially, the flask contains only air. After a short period of time, a light blue solution is added to the reaction flask. After another period of time, a clear solution is added to the flask, and the entire solution turns dark blue.



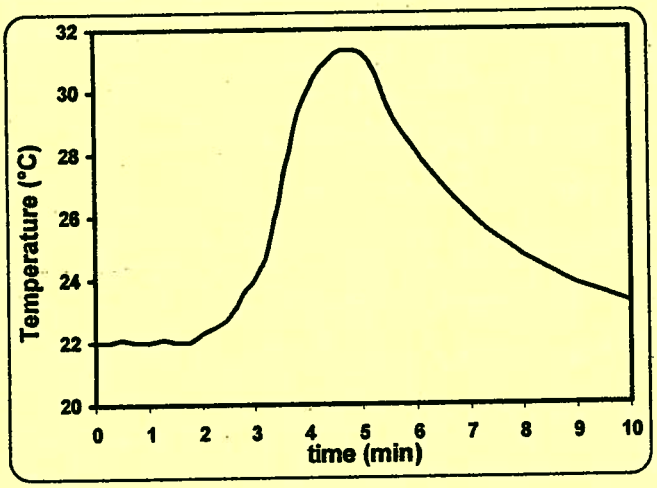
1. At what time is the light blue solution added to the reaction flask?

2. At what time does the dark blue solution begin to form?

3. The %Transmittance levels off at about 8 minutes. What is happening in the reaction flask?

4. After 15 minutes, another solution is added to the reaction flask and the % Transmittance returns to 100%. Did another reaction take place? Please explain your answer.

5. Two clear, colorless liquids are allowed to come to room temperature (22 °C). The timer is started and then the two solutions are mixed together to form another clear, colorless liquid. Looking at the graph to the right, at what time were the two solutions mixed together?



PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

PHYSICAL PROPERTY
1. observed with senses
2. determined without destroying matter

CHEMICAL PROPERTY
1. indicates how a substance reacts with something else
2. matter will be changed into a new substance after the reaction

Identify the following as a chemical (C) or physical property (P):

_____1. blue color
_____2. density
_____3. flammability (burns)
_____4. solubility (dissolves)
_____5. reacts with acid
_____6. supports combustion
_____7. sour taste
_____8. melting point
_____9. reacts with water
_____10. hardness
_____11. boiling point
_____12. luster
_____13. odor
_____14. reacts with air

PHYSICAL CHANGE
1. a change in size, shape, or state
2. no new substance is formed

CHEMICAL CHANGE
1. a change in the physical and chemical properties
2. a new substance is formed

Identify the following as physical *(P)* or chemical *(C)* changes.

_____1. NaCl (Table Salt) dissolves in water.
_____2. Ag (Silver) tarnishes.
_____3. An apple is cut.
_____4. Heat changes H_2O to steam.
_____5. Baking soda reacts to vinger.
_____6. Fe (Iron) rusts.
_____7. Alcohol evaporates .
_____8. Ice melts.
_____9. Milk sours.
_____10. Sugar dissolves in water.
_____11. Wood rots.
_____12. Pancakes cook.
_____13. Grass grows.
_____14. A tire is inflated.
_____15. Food is digested.
_____16. Paper towel absorbs water.

Physical and Chemical Changes

Part A

Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** (P) has occurred. If the substance has been changes into another substance, a **chemical change** (C) has occurred.

1.		An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.		Two chemical are mixed together and a gas is produce.
3.		A bicycle changes color as it rusts.
4.		A solid is crushed to a powder.
5.		Two substances are mixed and light is produced.
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrup is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

Part B

Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision. The first one has been done for you to use as an example.

	Scenario	Physical or Chemical Change?	Evidence...
1.	Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
2.	Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen if full of smoke.		
3.	You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.		
4.	You blow dry your wet hair.		

5.	In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.		
6.	You take out your best silver spoons and notice that they are very dull and have some black spots.		
7.	A straight piece of wire is coiled to form a spring.		
8.	Food color is dropped into water to give it color.		
9.	Chewing food to break it down into smaller particles represents a _____ change, but the changing of starch into sugars by enzymes in the digestive system represents a _____ change.		
10.	In a fireworks show, the fireworks explode giving off heat and light.		

Part C: True (T) or False (F)

1.		Changing the size and shapes of pieces of wood would be a chemical change.
2.		In a physical change, the makeup of matter is changed.
3.		Evaporation occurs when liquid water changes into a gas.
4.		Evaporation is a physical change.
5.		Burning wood is a physical change.
6.		Combining hydrogen and oxygen to make water is a physical change.
7.		Breaking up concrete is a physical change.
8.		Sand being washed out to sea from the beach is a chemical change.
9.		When ice cream melts, a chemical change occurs.
10.		Acid rain damaging a marble statue is a physical change.

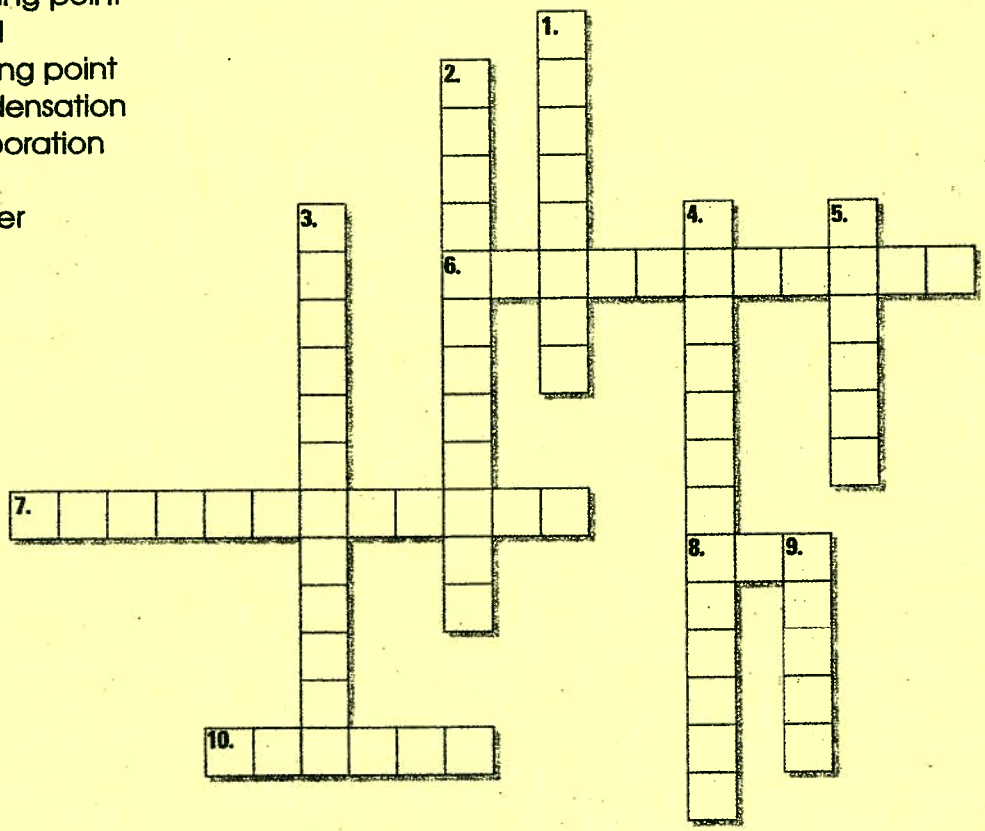
Physical Properties of Matter

Matter is anything that occupies space. All things consist of matter.

Directions: Match the terms below to the definitions. Then, solve the crossword puzzle about matter.

WORD BANK

boiling point
crystals
freezing point
liquid
melting point
condensation
evaporation
gas
matter
solid



ACROSS

6. The change of a liquid to a gas
7. The temperature at which a liquid has gained enough heat energy to change to a gas
8. A state of matter that has no fixed shape
10. A gas, liquid, or solid that has mass and takes up space

DOWN

1. Patterns of particles packed together in a repeating order
2. The change of a gas to a liquid when heat energy is lost
3. Temperature at which a solid becomes a liquid
4. Temperature at which a liquid becomes a solid
5. State of matter that has a fixed volume but no shape of its own
9. State of matter that has a fixed volume and shape

Topic 3: What Are Elements?

Taking Matter Apart:

Philosophers pondered and thought about many things. One topic, Matter, brought on much thought. Many ancient Greek philosophers thought all matter was made up of:

1.
2.
3.
4.

They called these for parts: _____. In their thoughts, everything was made up of a combination of these elements.

Through many centuries many investigations were carried out regarding matter. A group of people who were part pharmacist, part mystic tried to change "base" (meaning lower value) metals, such as lead and copper, could be changed into gold. These people were known as _____.

In about 400 B.C., the Greek philosopher Democritus used the word_____ to describe the smallest particles that could not be broken further. Atomos means "indivisible".

The current view of elements started to develop many hundreds of years ago. Boyle believed that the tiny particles, existing in various shapes and sizes, would group together in different ways to form individual substances. Boyle felt that the purpose of chemistry was to determine the types of particles making up each _____.

Lavoisier was a pioneer in the field . He defined elements as _____ that cannot be broken down into simpler substances. He identified _____ pure substances as elements.
As a scientist Lavoisier had very good techniques. One of these these techniques measuring _____ of all the substances involved in chemical changes.
These measurements led to "The _____".

ex.

Lavoisier's emphasis on measuring mass inspired other scientists to break down (decompose) compounds into their elements and to measure the mass of each element. The results of their experiments led to the "Law of _____"

Using the information on pg. 107 write down the information about the following 2 laws.

A. The Law of Conservation of Mass

B. The Law of Definite Composition

In the 19th century, scientists found a new way to investigate matter. This new way led scientists to determine that water was made from Hydrogen and Oxygen. What they did is pass an electric _____through water. This process is called _____. Electrolysis led to many questions.The properties of the compound, water, are different from the properties of the elements that make it up, hydrogen and oxygen.

Because of this, we could determine that the particles of water are different from the particles of water and oxygen. John Dalton introduced a new way of explaining chemical facts and laws of his _____.

Dalton's Atomic Theory

-
-
-
-

Because of Dalton's atomic theory and his "_____" model of an atom lead to a more accurate definition of elements and compounds.

Elements:

Compounds:

A Brief History of Atomic Models:

JJ Thomson:

Dalton's work on the structure of the atom was continued by British physicist J.J. Thomson. He is credited with being the first person to discover a _____ particle (a particle smaller than an atom). Thomson, experimenting with cathode rays, concluded that the rays were made up of streams of _____ charged particles. He showed that these particles were much smaller in mass than even a hydrogen atom. He named them _____. In 1897, Thomson proposed what is called the "_____" of the atom. He described the atom as a positively charged sphere in which negatively charged electrons were embedded like raisins in a bun.

Ernest Rutherford

Rutherford carried out much of his research at McGill University in Montreal from 1898 to 1907. Using Thomson's model, Rutherford conducted experiments in which he shot positively charged particles through thin gold foil. His results showed that almost all the mass of the atom was in the center (_____). The rest of the atom of was mostly empty space occupied by very small electrons. The name _____was given to the positively charged particle. He also calculated that the nucleus was only about 1/10 000th the size of the atom – like a green pea in a football field.

Niels Bohr

It was Danish researcher Niels Bohr who, working with Rutherford, suggested that electrons do not _____ randomly in an atom. Bohr said that they move in specific circular orbits, or electron shells, as shown in Figure 2.18. He believed that electrons jump between these shells by gaining or losing energy.

James Chadwick

Bohrs model was readily accepted, though with further refinements, by James Chadwick,. He discovered that the _____ontained positively charged particles called _____, and neutral particles called _____. The neutron has about the same mass as the proton but carries no electrical charge.

ATOMS

Atoms are the _____ of matter that make up everyday objects.

An **ATOM** is made of _____subatomic particles:

PROTONS

-
-
-
-

NEUTRONS

-
-
-
- symbol is *n*

ELECTRONS

-
-
-
- symbol is *e*

Topic 4 - Classifying Elements

Element Symbols

QUESTION 1:

Why are **element symbols** important to scientific communication around the world?

_____

_____

Metal	gold	silver	iron	mercury	tin	copper	Lead
Symbol	☉	☾	♂	☿		♀	
Celestial Body	Sun	Moon	Mars	Mercury	Jupiter	Venus	Saturn

John Dalton developed a new set of symbols in the early 1800's to improve communication between chemists.

Hydrogen	*Soda*	*Ammonia*
Nitrogen	*Pot Ash*	*Olefiant*
Carbon	*Oxygen*	*Carbonic Oxide*
Sulphur	*Copper*	*Carbonic Acid*
Phosphorus	*Lead*	*Sulphuric Acid*
Alumina	*Water*	

Berzelius later revised **Dalton's** symbols by replacing them with *letters*, instead of pictures. He represented the elements by their first letter (capitalized) or their first two letters (first one capitalized and the second letter lower case).

Elements were listed in order of their atomic mass. **ATOMIC MASS** is the mass of one atom of an element. It is represented in **atomic mass units (amu).**

Demitri Mendeleev later revised the pattern that scientists had made in 1869, when he organized the elements into the first periodic table.

Different Kinds of Elements

QUESTION 2:

How many individual elements have been identified?

_____

QUESTION 3:

There are three kinds of elements.

a. Name the three groups of elements.

_____

b. Which of these groups has the most elements?

_____

c. Which element of the metalloids is the most abundant in Earth's crust?

d. Which kind of element is solid, brittle, and not ductile?

_____

One way of classifying elements is to sort them into categories, based on their distinct properties. Long before anyone knew any detail about the atoms or any of the periodic properties the elements were divided into two broad categories → metals and non-metals.

Distinct properties of _____ were:

- malleability and ductility,
- shiny lustre
- solid at room temperature (except mercury).
- Conductors of electricity and heat

Distinct properties of _____ are:

- can be gases, solids or liquids
- (solid non-metals are brittle)
- dull
- non-conductors of electricity or heat.

In-between elements were called **metalloids**, having properties of both metals and non-metals.

_____ – the 38 elements in groups 3 to 12 are called transition metals. The only elements in this group known to produce a magnetic field are iron, cobalt, and nickel.

_____ – there are 7 elements considered "other metals" in groups 13 to 15. All these elements are solid with a high density. Examples are tin, aluminum, and lead.

_____ – these elements have both metal and non-metal properties. Some of them are semi-conductors, which means, they can carry an electrical charge under special conditions. Metalloids are great for computers and calculators.

_____ – these fall into groups 14 and 16 in the periodic table. They can't conduct heat or electricity very well and are brittle. They also can't be made into wire or sheets. At room temperature, non-metals turn into gasses and solids.

_____ – there are 30 rare earth elements. Many of them are synthetic or man-made. They're found in group 3, 6 and 7 of the periodic table of elements.

Chemical Families

Chemical family is a term used to describe a group of related elements that have similar properties.

Alkali Metals – these are found in group 1 of the periodic table. They don't occur freely in nature and are softer than most metals. Like all metals, they are great heat conductors and can even explode if exposed to water; they are very reactive and need special storage. They easily give off an unpaired electron by forming a compound.

QUESTION 4:
Why are **ALKALI METALS** reactive?

_____

Alkaline Earth Metals – these are found in group 2 on the periodic table. Since they are extremely reactive, they aren't found freely in nature. An example of an alkaline earth metal is radium.

Noble Gases – the 6 noble gases are in group 18. All of them have the maximum number of electrons possible in their outer shell, which makes them more stable. Examples of noble gases are helium, neon and krypton.

Halogens – all 5 halogens are non-metallic elements. Compounds that contain halogen are called "salts". At room temperature, they are in three states; solid, liquid, and gas.

QUESTION 5:

The element argon was the first noble gas to be discovered.

a. What is the main characteristic of a noble gas?

_____

b. Why do they all have this characteristic?

_____

QUESTION 6:

Why are the halogens reactive?

_____

KEY TERMS:

- **ELEMENT SYMBOLS:** one or more letters used to represent the name of a substance
- **METAL:** conduct heat and electricity, are malleable and ductile, have lustre and are a solid at room temperature (except mercury)
- **NON-METAL:** can be solid, liquid, or gas at room temperature, brittle (when solid), are not malleable or ductile, do not have lustre and do not conduct heat/electricity
- **METALLOID:** elements with properties in between metals and non-metals
- **ALKALI METALS:** most reactive; include Li, Na, K, Rb, Cs, Fr
- **ALKALI EARTH METALS:** not as reactive as alkali metals; include Be, Mg, Ca, Sr, Ba, Ra
- **NOBLE GASES:** unreactive; include He, Ne, Ar, Kr, Xe, Rn
- **HALOGENS:** react with almost any other compound; include F, Cl, Br, I, At

You have learned that the atomic number is based on the number of protons or electrons of an atom. There is another method of describing atoms. This method uses the number of neutrons and protons. THE NUMBER OF NEUTRONS AND PROTONS OF AN ATOM IS CALLED ITS ATOMIC WEIGHT (MASS).

In the case of ATOMIC WEIGHT, the weight (or mass) is not given in grams or ounces. It is given in ATOMIC MASS UNITS (a.m.u.). You can figure out the atomic weight of an atom:

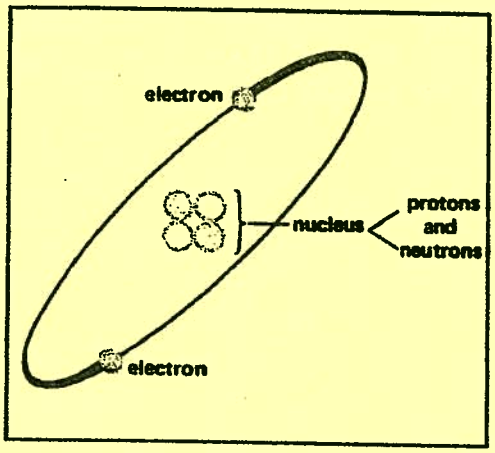
Each PROTON is given a weight of one.
Each NEUTRON is given the weight of one.

As strange as it may seem, atomic weights are not usually whole numbers. Look at the symbol description for sulfur (S) on page 79. Its ATOMIC NUMBER is 16. Its ATOMIC WEIGHT is 32.06.

How can the atomic weight be 32.06 instead of exactly 32? After all, 16 protons plus 16 neutrons equals 32. BUT, not all sulfur atoms have 32 neutrons in the nucleus. A very small percentage of them have 17 neutrons! These atoms raise the AVERAGE atomic weight of sulfur to 32.06.

We have learned something new here. Atoms of the same element are not all EXACTLY alike. They may have different numbers of neutrons. But, all atoms of the same element have the same number of protons. Thus, they all have the same atomic number. Atoms of the same element that have different numbers of neutrons are called *isotopes* (EYE suh topes) of that element.

A.



NUCLEUS

PROTONS + NEUTRONS = ATOMIC WEIGHT

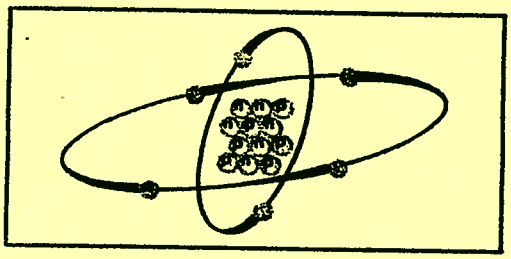
Each proton has a value of one.

Each neutron has a value of one.

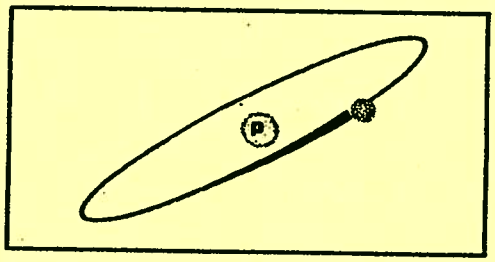
ATOMIC WEIGHT, PLEASE

1. The diagrams below show six different atoms. Look at each one closely. Find the atomic weight of each atom. Write your answer in the space below the diagram.

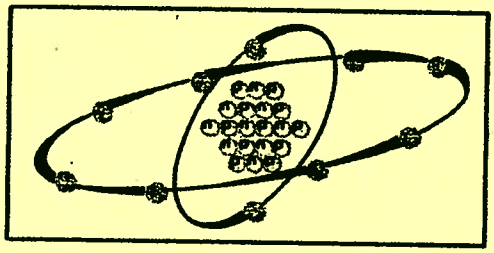
Remember: atomic weight = protons + neutrons



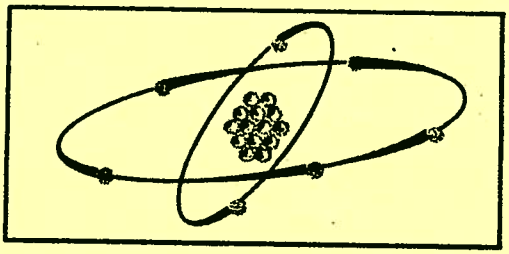
B. Atomic Weight _____



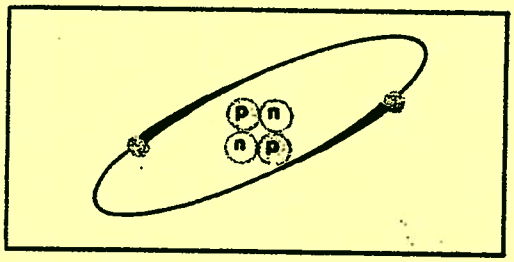
C. Atomic Weight _____



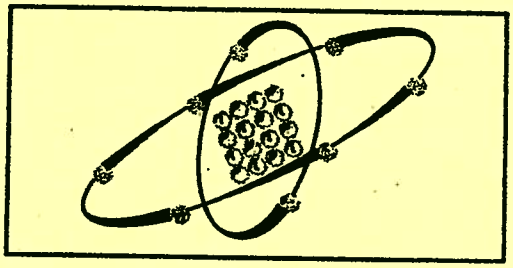
D. Atomic Weight _____



E. Atomic Weight _____



F. Atomic Weight _____



G. Atomic Weight _____

The table below lists fifteen different atoms. The number of protons and neutrons in each atom is also listed. Use that information to find the atomic weight of each of these elements. Write your answer in the last column.

Name of element	Number of protons	Number of neutrons	Atomic weight
1. cobalt	27	32	
2. zinc	30	35	
3. krypton	36	48	
4. hydrogen	1	0	
5. potassium	19	20	
6. gold	79	118	
7. arsenic	33	42	
8. sulfur	16	16	
9. iodine	53	74	
10. tungsten	74	110	
11. silver	47	61	
12. uranium	92	146	
13. lead	82	125	
14. calcium	20	20	
15. oxygen	8	8	

20

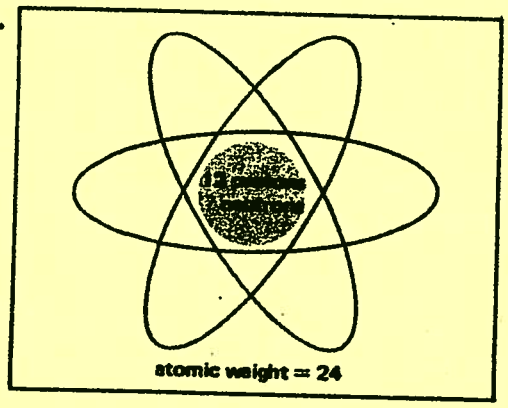
WHAT DO THE PICTURES SHOW?

Each picture below shows an atom. Some information is given about each atom. Use this information to answer the questions about each atom.

REMEMBER, P rotons
E lectrons
A tomic number
and

protons + neutrons = atomic weight

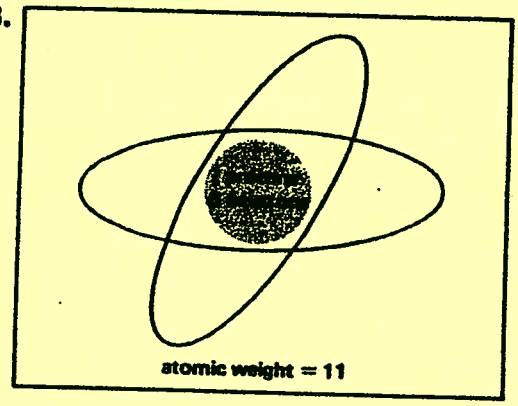
A.



A.

1. How many neutrons does this atom have? _____
2. How many electrons? _____
3. What is the atomic number? _____
4. What is the name of this atom? _____
5. What is its symbol? _____

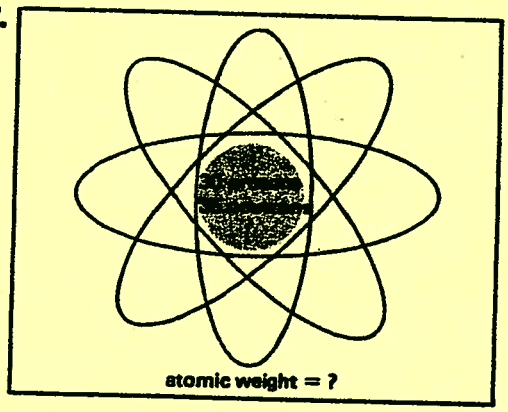
B.



B.

1. How many protons does this atom have? _____
2. How many electrons? _____
3. What is the atomic number? _____
4. What is the name of this atom? _____
5. What is its symbol? _____

C.



C.

1. What is the atomic weight of this atom? _____
2. How many electrons? _____
3. What is the atomic number? _____
4. What is the name of this atom? _____
5. What is its symbol? _____

COMPLETE THE CHARTS

I. This chart lists the parts of the atom.

Tell: a) where each part is found,
b) its electric charge, and
c) its weight.

Part of Atom	Where Found	Electric Charge	Weight
proton			
neutron			
electron			

Don't worry about filling in this space. An electron is so light in weight that 1,845 of them are needed to equal the weight of one proton or one neutron.

II. This chart lists five elements. Some information is listed for each. Some information is missing. Fill in the missing information.

Remember: atomic weight = protons + neutrons

and

P rotons
E lectrons
A tomic number

Element	Protons	Neutrons	Atomic Weight	Electrons	Atomic Number
1. oxygen	8		16	8	8
2. carbon		6	12		
3. sodium			23	11	
4. phosphorus		16			15
5. potassium	19	20			

USING THE PERIODIC TABLE

The Periodic Table lists each atomic weight as a whole number followed by two decimals. In the classroom, we do not use decimals. We round off the decimal to its nearest whole number.

Use this knowledge to fill in the chart. The first two are done as examples.

Element	Listed Atomic Weight	Atomic Weight Rounded Off
1. oxygen	15.99	16
2. carbon	12.01	12

NOW TRY THESE YOURSELF.

3. neon	20.18	
4. iron	55.84	
5. arsenic	74.92	
6. magnesium	24.31	

Use the Periodic Table to complete the rest of the chart.

1. **Find each element on the Periodic Table.**
2. **Write down the listed atomic weight.**
3. **Round it off.**

Element	Listed Atomic Weight	Atomic Weight Rounded Off
7. silver		
8. hydrogen		
9. calcium		
10. barium		

Let's try it another way. Fill in the missing information.

11.		65
12.	126.90	
13.		40
14.	26.98	
15.	200.59	

MULTIPLE CHOICE In the space on the right, write the letter that best completes each sentence.

1. Atoms are made up of
   a) protons only.
   b) protons and neutrons only.
   c) protons, neutrons, and electrons.

   1. _____
2. A nucleus has
   a) protons, neutrons, and electrons.
   b) protons and neutrons.
   c) only electrons.

   2. _____
3. Hydrogen is the only atom that has no
   a) protons.
   b) neutrons.
   c) electrons.

   3. _____
4. An atomic weight equals
   a) protons plus electrons.
   b) electrons plus neutrons.
   c) protons plus neutrons.

   4. _____
5. Which of these atoms has the most protons? (Use the Periodic Table to find the answer.)
   a) sodium
   b) iodine
   c) aluminum

   5. _____

TRUE OR FALSE Write T on the line next to the number if the sentence is true. Write F if the sentence is false.

1. _____ An atom has no weight.
2. _____ An electron is the heaviest part of an atom.
3. _____ All atoms weigh the same.
4. _____ All protons weigh the same.
5. _____ All oxygen atoms weigh the same.
6. _____ An oxygen atom can weigh the same as a hydrogen atom.
7. _____ To find the atomic weight of an atom, we add the protons and electrons.
8. _____ The atomic weight of bromine is 79.90. The rounded off weight is 79.

INDICATING THE PHYSICAL STATE OF A COMPOUND

- Another common notation added to chemical compounds indicates the state of the chemical at room temperature. After the chemical formula, a subscript **s** for solid, **l** for liquid, or **g** for gas is shown in parentheses. For example, sodium chloride is written as $NaCl_{(s)}$, water is written as $H_2O_{(l)}$, and natural gas (methane) is written as $CH_{4(g)}$. For _____ solutions (substances dissolved in water), a subscript **aq** in parentheses is added to the formula. So, if sodium chloride was dissolved in water, the resulting aqueous solution would be written as $NaCl_{(aq)}$.

QUESTION 1:
Indicate which statement describes ionic compounds and which describes molecular compounds. Write down "I" for ionic or "M" for molecular for each statement.

a. An aquatic solution of this type of compound does not conduct electricity.

b. Atoms of one element give electrons to atoms of the other element during the formation of this type of compound.

c. This type of compound conducts electricity when in solution.

d. This type of compound is a solid at room temperature.

e. This type of compound is generally formed from only elements on the right side of the periodic table.

f. It does not form ions when dissolving in water.

g. It forms charged particles—or groups of charged particles—when in an aquatic solution.

h. This type is formed from the chemical combination of a metallic and a non-metallic element.

i. Its atoms share electrons rather than transferring them.

QUESTION 2:
Aluminum is made from a substance called alumina, which has the formula Al_2O_3.

a. Based on the formula, what are the two elements in alumina?

Molecular Compounds vs. Ionic Compounds

Even though we can't see what is happening to the atoms in a compound, we can tell whether a compound is molecular and ionic by studying its properties (characteristics).

Properties of Molecular Compounds

- made by mixing different non-metals
- do not break apart into ions in solutions (wet mixtures)
- do not conduct electricity
- solid, liquid or gas at room temperature

Properties of Ionic Compounds

- made by mixing metals with non-metals
- break apart into ions in solutions (wet mixtures)
- conduct electricity
- solid at room temperature

Use the information above to help you identify whether each of the following descriptions are of compounds that are **molecular** or **ionic**.

1. _____ Carbon Dioxide is a gas at room temperature.
2. _____ Salt is made by mixing Sodium (a metal) and Chlorine (a non-metal).
3. _____ Silver Nitrate can conduct electricity.
4. _____ When sugar is mixed with water to make a solution, it doesn't break apart into ions.
5. _____ When salt is mixed with water to make a solution, it breaks apart into ions.

Part H: How do chemical compounds get their names?

Rules for Naming Chemical Compounds with Words

Molecular Compounds (of two elements)

1. Write the whole name of the first element
2. Add a number prefix to the second element to show how many atoms there are.
   - mono = 1
   - di = 2
   - tri = 3
   - tetra = 4
3. Add the name of the second element but change the ending to *ide*

For example: *Carbon tetrachloride*

Ionic Compounds (of two elements)

1. Write the whole name of the metallic element first.
2. Add *of* to the second element but change the ending to *ide*.

For example: *Sodium chloride*

Did you notice that the only difference between the names of molecular and ionic compounds is whether or not we say the numbers?

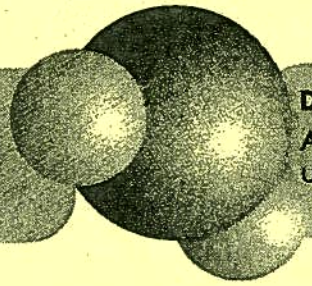
Use the information above to help you identify whether each of the following names are compounds that are **molecular** or **ionic**.

1. _____ Carbon Dioxide
2. _____ Calcium Oxide
3. _____ Carbon Tetrachloride
4. _____ Magnesium Nitride
5. _____ Carbon Monoxide

Part G: What are chemical compounds?

Before learning about chemical compounds, it's important to know the following terms and definitions:

Molecule
A group of neutral atoms bonded (joined) together.



Diatomic Molecule
A diatomic molecule is always made up of pairs of the same kind of atom.

Ion
An ion is an atom that is no longer neutral. It now has a positive or negative charge because it has either lost or gained electrons. If there are more electrons than protons, the ion is negatively charged; but, if there are more protons than electrons, the atom is positively charged.

Chemical Compounds
A compound is formed whenever two or more elements are chemically joined (stuck together at the atom level) to form a new chemical with new properties (characteristics).

Molecular Compounds
A molecular compound is formed by mixing two or more non-metal elements together. The atoms in each element get mixed up and form new bonds (their inner particles are stuck together in a new way). In molecular compounds, the atoms stick together because they are sharing electrons.

Ionic Compounds
An ionic compound is formed by mixing elements whose atoms have become positively or negatively charged. Instead of just sticking together, the atoms actually trade pieces and become new atoms. In ionic compounds, the atoms stay together because they are trading electrons.

Use the information on page 22 to help you fill in the blanks in these sentences.

1. A _____ contains neutral atoms.

2. An ion is a positively or negatively _____ atom that has either gained or lost _____.

3. A _____ molecule is made up of pairs of atoms.

4. Molecules and molecular compounds are made up of _____ atoms.

5. Ionic compounds are made up of atoms that are _____ or _____ charged.

6. To become "charged," an atom must gain or lose _____.

7. A chemical compound is formed whenever two or more elements are _____ joined (stuck together at the atom level).

States of Matter

Chemical formulas (especially when they are written in reaction equations like the one below) usually have a letter in brackets afterwards to tell you know what state the substance is in at room temperature.

s = solid g = gas l = liquid

Use what you have learned about naming chemical compounds to help you fill in the missing information in the explanation of this chemical reaction.

$$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$$

At room temperature, _____ (1) is in a _____ (2) state. When it comes into contact with pure _____ (3), the chemicals _____ (4) and form _____ (5) _____ (6), which is a _____ (7). Each _____ (8) in the gas is made up of _____ (9) atom of _____ (10) and a _____ (11) of atoms of _____ (12).

In this chemical _____ (13), the _____ (14) are carbon and oxygen. The _____ (15) is carbon dioxide.

The missing words from the passage are:

oxygen carbon reactants solid one
carbon react gas molecule product
oxygen pair reaction carbon dioxide

Rules for Changing Chemical Compound Names to Formulas with Words

Chemical Formulas

Chemical compounds are also named using chemical formulas. A set of letters and numbers tell you which elements are in the compound and how much of each element there is.

Changing Names to Formulas

1. Write the symbols for the elements (found on the periodic table) in the order they are in the name of the compound, e.g., carbon dioxide.
2. Use subscripts (little numbers in the bottom right-hand corner) to show how many atoms of each element, e.g., CO_2.

Use the information on the last few pages to help you write the chemical formulas for the following compounds:

Example: **Carbon Dioxide**

Symbol for first element:	**C**
Subscript (little number) on first element:	
Symbol for second element:	**O**
Subscript (little number) on second element:	**di = 2**
Chemical Formula =	**CO_2**

Hint: If there is no subscript, leave the space blank.

1. **Hydrogen Dioxide**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Prefix on second element: _____
   Chemical Formula: _____

2. **Sodium Chloride**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Subscript on second element: _____
   Chemical Formula: _____

3. **Dinitrogen Trioxide**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Subscript on second element: _____
   Chemical Formula: _____

4. **Carbon Monoxide**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Subscript on second element: _____
   Chemical Formula: _____

5. **Carbon Tetrachloride**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Subscript on second element: _____
   Chemical Formula: _____

6. **Silver Chloride**

   Symbol for first element: _____
   Subscript on first element: _____
   Symbol for second element: _____
   Subscript on second element: _____
   Chemical Formula: _____

Chemical Compounds

1. Name 4 properties of molecular compounds

1. _____

2. _____

3. _____

4. _____

2. Name 4 properties of ionic compounds

1. _____

2. _____

3. _____

4. _____

3. Molecular compounds **transfer/share** ***electrons.***

4. Ionic compounds **transfer/share** ***electrons.***

5. What is a(n):

a) *Molecule*:

_____

_____

b) Diatomic Molecule:

_____

_____

c) *Ion*:

_____

_____

6. The formula for hydrogen peroxide is $H_2O_{2\,(l)}$.

a) Which elements are present? _____

b) How many atoms are in each molecule? _____

7. Name the following MOLECULAR compounds

a. PCl_2 _____

b. CCl_4 _____

c. NO_2 _____

d. N_3F_4 _____

e. H_2O _____

f. NH_3 _____

g. CH_4 _____

8. Name the following IONIC compounds

a. Kbr _____

b. $FeCl_3$ _____

c. NaOH _____

d. $FeCl_3$ _____ *(Note: Iron can be 2+ or 3+)*

e. MgO _____

f. NaCl _____

g. K_2S _____

9. Indicate whether the compounds are ionic or molecular

a. Sodium hydroxide _____

b. tricholorine monoiodide _____

c. Potassium sulfide _____

d. Aluminum fluoride _____

e. Carbon monoxide _____

f. dihydrogen monosulfide _____

10. Identify the <u>NUMBER</u> and <u>KINDS</u> of atoms found in the following compounds:

a. Citric acid ($C_6H_8O_7$)

_____

b. Caffeine ($C_8H_{10}N_4O_2$)

_____

c. Estrogen ($C_{18}H_{24}O_2$)

_____

11. Predict the following ionic compounds using what you learned in class (symbolically and in words):

a. $Ca^{2+} + Cl^{1-}$ _____

b. $Mg^{2+} + N^{3-}$ _____

c. $Fe^{3+} + S^{2-}$ _____

d. $Pb^{4+} + F^{1-}$ _____

MULTIPLE CHOICE

Please choose the best answer from the options provided.

1. The "amu" is the basis of the element classification system. What does the symbol "amu" stand for?
   a. atomic measurement unit
   b. atomic mass unit
   c. astronomical mass unit
   d. astronomical measurement unit

2. A family of elements is
   a. located in a vertical column in the periodic table.
   b. located in a horizontal row in the periodic table.
   c. a group of elements related by atomic mass.
   d. another name for a period in the periodic table.

3. What does the atomic number of an element represent?
   a. The number of electrons in the atom.
   b. The number of protons in the nucleus.
   c. The number of neutrons in the nucleus.
   d. The number of protons and neutrons in the nucleus.

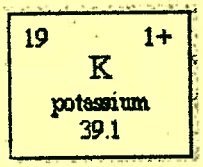
4. Water (H_2O) is a common compound. What is it made up of?
   a. 3 elements and a total of 3 atoms.
   b. 2 elements and a total of 3 atoms.
   c. 3 elements and a total of 2 atoms.
   d. 2 elements and a total of 2 atoms.

5. How many elements are present in two molecules of Aspirin? The formula for Aspirin is $C_9H_8O_4$.
   a. 3
   b. 21
   c. 6
   d. 42

6. Most atoms are neutral. What happens to an atom to make it into a positive ion?
   a. It loses electrons and protons.
   b. It gains electrons.
   c. It loses electrons.
   d. It gains electrons and protons.

7. When two elements combine to form a compound, the properties of the compound
   a. can be predicted by averaging the properties of the original elements.
   b. will be similar to at least one of the original elements.
   c. may be very different from those of the original elements.
   d. can be predicted by finding the compound's location in the periodic table.

Use the following diagram to answer the next three questions.



8. The periodic table provides the following information for potassium. What is the ion charge for potassium?
   a. 39.1
   b. 1+
   c. 20
   d. 19

9. What is the atomic mass of potassium?
   a. 39.1
   b. 1+
   c. 20
   d. 19

10. What is the atomic number of potassium?
    a. 39.1
    b. 1+
    c. 20
    d. 19

11. Iron combines with oxygen to form iron (II) oxide or iron (III) oxide. What is the main difference between iron (II) and iron (III)?
    a. Charge of the iron ion.
    b. Number of protons in the iron atom.
    c. Placement of the iron atom in the periodic table.
    d. Size of the iron atom.

12. Carbon monoxide and carbon dioxide are molecular gases produced by car engines. How are their structures different?
    a. Carbon dioxide has two more carbon atoms than carbon monoxide.
    b. Carbon dioxide has one more oxygen atom than carbon monoxide.
    c. Carbon dioxide has one more carbon atom than carbon monoxide.
    d. Carbon dioxide has two more oxygen atoms than carbon monoxide.

13. You want to make an aqueous solution of sodium chloride. What do you dissolve the salt in?
    a. air
    b. water
    c. vinegar
    d. oxygen gas

14. Potassium combines with nitrogen to form an ionic compound. What is the correct name of this compound?
    a. potassium nitrate
    b. potassium nitrite
    c. potassium nitrogen
    d. potassium nitride

15. The element tin has a mass number of 119. Its atomic number is 50. How many electrons does an atom of tin have?
    a. 50
    b. 119
    c. 69
    d. 19

16. One atom of mercury possesses 80 protons, 80 electrons, and 121 neutrons. What is the mass number of mercury?
    a. 160
    b. 201
    c. 281
    d. 41

17. Phosphorous has a mass number of 31 and its atomic number is 15. How many neutrons are in an atom of phosphorous?
    a. 16
    b. 15
    c. 46
    d. 31

18. Each atom contains an equal number of
    a. electrons and protons.
    b. protons and neutrons.
    c. electrons and neutrons.
    d. electrons, protons, and neutrons.

19. When the "staircase" is drawn into the periodic table, where are the metals found?
    a. The metals are separated by the staircase.
    b. The metals are found to the right of the staircase.
    c. The metals are found along the top row of the staircase.
    d. The metals are found to the left of the staircase.

20. How many different groups are in the periodic table?
    a. 7
    b. 18
    c. 103
    d. 16

21. Which of the following chemical families lies in Group 2?
    a. Alkali metals
    b. Alkaline earth metals
    c. Noble gases
    d. Halogens

22. Write the correct formulas in the spaces below by using the valence of the elements.

	S^{-4}	Br^{-2}	O^{-2}	Cl^{-1}
Na^{+1}			Na_2O	
Al^{+5}				
Mg^{+2}		MgBr		

23. Write down the valence of the elements from the following compounds.

Formula	Atoms and Valences	
Mg_2N_4	Mg^{+4}	
Fe_3Cl_2		

24. Identify the following as either molecular (m) or ionic (I).

_____ Phosphorus dicholoride
_____ Iron (ii) chloride
_____ Potassium sulfide
_____ tetracarbon monochloride

25. Name the following compounds:

a. NH_3 _____
b. KBr _____
c. N_2F_4 _____
d. AlF_3 _____

Topic 7 – Chemical Reactions

A **chemical reaction** takes place when two or more substances combine to form new substances. Different types of chemical reactions can occur, including ***combination***, ***decomposition***, ***displacement*** and ***exchange*** reactions. The substances at the beginning of the reaction are called **reactants**. The new materials produced by the reaction are called **products**. The properties of the products differ from those of the reactants, thus a chemical change has occurred. A **chemical change** results from a chemical reaction. Evidence that a chemical change has occurred include:

- a change in colour
- the formation of an odour
- the formation of a solid (precipitate) or a gas (bubbles)
- the release or absorption of energy
  - a chemical change, which **releases** energy, is called **EXOTHERMIC.**
  - a chemical change, which **absorbs** energy, is called **ENDOTHERMIC.**

Chemical Equations

Chemical reactions can be written as **word equations**, which give the names of all the reactants (separated by a "plus' sign +) followed by an arrow which points to the names of all the products (separated by a "plus" sign +).

iron + oxygen + water ⟶ rust

Iron plus oxygen plus water produces rust

REACTANTS ⟶ PRODUCTS

Combustion is a chemical reaction that occurs when oxygen reacts with a substance to form a new substance and gives off energy.

Identification Tests

OXYGEN:
Light a wooden splint. Blow out the flame, allowing the splint to continue glowing. Hold the glowing splint in a small amount of the unknown gas. If the splint bursts into flame, then the gas being tested is oxygen.

HYDROGEN:
Light a wooden splint. Hold the glowing splint in a small amount of the unknown gas. If you hear a "pop", then the gas being tested is hydrogen.

CARBON DIOXIDE:
If you put a burning splint into carbon dioxide, the flame will go out and you will know the gas is not oxygen or hydrogen, but you will not know for sure that it is carbon dioxide. The test for carbon dioxide is not a combustion test, but rather uses a liquid called **limewater** (a clear colorless solution of calcium hydroxide, or slaked lime). Bubble the unknown gas through the limewater solution, or add a few drops of the limewater solution to the gas and swirl it around. If the limewater turns ***milky***, the gas is carbon dioxide.

Although a chemical equation may look complicated, by knowing what you know now, it should be much easier to understand.

$HC_2H_3O_{2(l)} + NaHCO_{3(g)} \longrightarrow NaC_2H_3O_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

(vinegar) (baking soda) (sodium acetate) (water) (carbon dioxide)

Breaking Chemical Bonds

Chemical bonds are forces that cause a group of atoms to behave as a unit. Energy is stored in these bonds. To break the bonds energy must be added. When bonds form, energy is released. All chemical reactions involve energy being absorbed ENDOTHERMIC, or released EXOTHERMIC. Photosynthesis is an endothermic reaction, because it needs light energy to occur, whereas combustion is an exothermic reaction, because it gives off light and heat.

DATE: NAME: CLASS:

TOPIC 7

REINFORCEMENT

Chemical Reactions

BLM 2-15

Goal • Review your understanding of terms used in Topic 7.

1. (a) Substances that go into a chemical reaction are called _____.
   (b) Substances produced by a chemical reaction are called _____.

2. Many changes may occur in the properties of substances involved in chemical reactions. List four of the changes.

   _____

   _____

   _____

   _____

3. Chemical equations are used by scientists worldwide to share information. What are the symbols used for the following reactions?
   (a) A solid is formed _____
   (b) A gas is formed _____
   (c) An electric current is needed for the reaction _____
   (d) Light is needed for the reaction to be complete _____

4. Write the word equation for the reaction between vinegar and baking soda

   _____

   _____

5. (a) Chemical reactions that give off heat are called _____reactions.
   (b) Chemical reactions that require heat are known as _____reactions.

6. Fill in the blanks. (Hint: All three blanks need the same word.)
   _____ is stored in chemical bonds. To break chemical bonds, _____ must be added. When chemical bonds form, _____ is released.

7. Write the chemical equation for the burning of methane.

   _____

Topic 8 – Reaction Rate

The speed of a chemical reaction is called the **reaction rate.**

- **Temperature** of the reactants affects the rate of all reactions. The higher the temperature, the faster the reaction rate.
- **Surface Area** of the reactants affects the reaction rate. The more surface in contact, the faster the reaction rate.
- **Concentration** of the reactants affects the reaction rate. The higher the concentration, the faster the reaction rate.
- **The presence of a Catalyst** affects the reaction rate.

Speeding Up a Reaction with Catalysts

A catalyst is a substance that helps a reaction proceed faster and is not consumed in the reaction. Types of reactions involving catalysts can be found in living and non-living things. Enzymes are natural catalysts that help in the reactions in the body; they break down food. They also get rid of poison in the body. *Catalase* (an enzyme found in plant and animal cells) speeds up the breaking down of hydrogen peroxide into harmless oxygen and water.

Slowing Down a Reaction with Inhibitors

Inhibitors are substances that slow down chemical reactions. Plants have natural inhibitors in their seeds to prevent germination until the right conditions are present. Inhibitors are added to foods to slow down their decomposition.

Corrosion

Corrosion is a slow chemical change that occurs when oxygen in the air reacts with a metal. Corrosion is a chemical reaction in which the metal is decomposed (eaten away), when it reacts with other substances in the environment. The corrosion of iron is called '*rusting*'.

Many metals can corrode. The green roofs of the parliament buildings are an example of corrosion. The red - brown copper color is replaced with the green color because copper corrodes. Gold does not corrode. Solid solutions of metals (alloys) resist corrosion.

Preventing Corrosion

Corrosion protection (e.g. painting the metal) involves protecting metal from contact with the environment and the factors that affect the reaction rate of this chemical reaction. Coating a corrosive metal with a thin layer of zinc is called galvanization. The process of coating a corrosive metal with another metal through electrolysis (review p.110) is called electroplating.

Combustion

Combustion is the highly exothermic combination of a substance with oxygen. Combustion requires heat, oxygen, and fuel.

Products of Combustion

The burning of propane (C_3H_8) in a barbeque is an exothermic reaction that produces heat to cook the food. If the heat is too intense, the products being cooked will be changed into pure carbon (the meat will be burnt). The products of combustion are not always beneficial. Burning fossil fuels (such as propane) produces carbon monoxide, carbon dioxide, sulfur oxides, nitrogen oxides, smoke, soot, ash and heat. Some of these products are pollutants which will be covered in more detail in **Environmental Chemistry – Unit C.**

DATE: NAME: CLASS:

TOPIC 8
VOCABULARY CHECK

Rates of Reactions

BLM 2-16

Goal • Review your understanding of Topic 8.

What to Do

Use the clues to fill in the blanks and solve the hidden word.

1 ☐ _ _ _ _ _ _ _ _

2 _ _ _ _ _ ☐ _ _ _ _ _

3 _ _ _ _ _ ☐ _ _

4 _ _ _ _ _ ☐ _ _ _ _ _

5 _ _ _ _ _ _ ☐ _ _

6 _ _ ☐ _

7 _ _ ☐ _ _ _ _ _

8 _ _ _ _ _ _ _ ☐ _ _ _ _ _ _ _

9 _ _ _ _ _ ☐ _ _ _ _ _

10 _ _ _ _ _ _ _ _ _ ☐ _ _ _ _ _

Clues

1. Substances are often added to a chemical reaction to speed up a reaction. If such a substances does not get changed in the reaction , it is called a ....
2. The oxidation of metals or rocks in the presence of air and moisture
3. Natural catalysts such as those in the saliva in your mouth are known as....
4. This slows down a reaction
5. Computer equipment is often shipped with a small package of desiccants. Silica gel is a desiccant used to absorb .... from the air.
6. Type of corrosion
7. CH_4
8. Coating metals with a thin layer of zinc
9. Fe_2O_3
10. The measure of how fast a reaction occurs is known as the ....

HIDDEN WORD _____

Name: _____

Clock Work Reaction

Question: Is the clock work reaction a chemical or physical change and what properties prove this?

Hypothesis:

_____

_____

_____

_____

Materials:

-3 Clear Containers
-60 ml of warm water
-1000mg of Vitamin C
-2% Tincture of Iodine
-3% Hydrogen Peroxide
-1/2 teaspoon of cornstarch (2.5 ml)
-Safety Goggles
-Measuring spoons
-Measuring cups
-Mortar and Pestle

Procedure:

1. Put on safety goggles and grind vitamin C in the mortar to a fine powder.
2. Place powder into a container labeled "Liquid A" and add 60ml of warm water. Stir for 30 seconds.
3. Take 5ml of "Liquid A" and place into a new container labeled "Liquid B". Add 60 ml of warm water and 5ml of Iodine. The brown liquid will turn clear.

4. In the last container labeled "Liquid C" add 60 ml of warm water and 15ml of the Hydrogen Peroxide. Add ½ teaspoon of cornstarch.
5. Pour Liquid B into Liquid C and mix. Observe and record results.

Results:

What did you see (BE SPECIFIC):

_____

_____

_____

_____

_____

_____

Conclusion: Was your hypothesis correct? Why or why not?

_____

_____

_____

_____