

## PRE- NOTE QUESTIONS!

Matter is anything that takes up space and has mass.

- ①. Name five things that have matter.
  
- ②. Name five things that do not have matter.
  
- ③. How can you tell the difference?

**CHEMISTRY: THE  
SCIENCE OF MATTER**

**The Puzzle of  
Matter**

# ST. 5- TYPES OF MATTER

## OBJECTIVES

- ①) Types of Matter vs Energy
- ②) Mixtures
- ③) Elements and Compounds

# ST. 5- TYPES OF MATTER

## DETAILED OBJECTIVES

- Is able to differentiate between elements, compounds and mixtures and recognize each in terms of particle arrangement.
- Recognizes or recalls specific terminology such as:
  - matter, solid, liquid, gas, element, compound, mixture
- Performs basic processes, such as:
  - Classify matter as pure substance or mixture
  - Identify matter as a solid, liquid, gas

# CHEMISTRY

- ⦿ The science that investigates and explains the structure and properties of matter.
- ⦿ Matter is anything that takes up space and has mass.

# MATTER OR NOT MATTER

- ◉ IRON
- ◉ HEAT
- ◉ CANDY
- ◉ SUNLIGHT
- ◉ SOUND
- ◉ POTATOES
- ◉ WATER

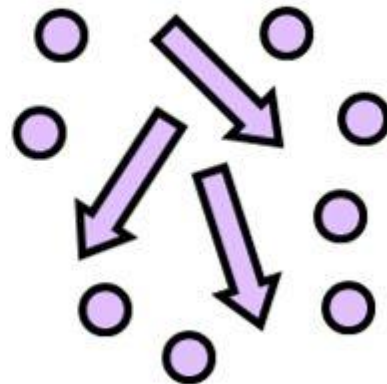
# MATTER VS. ENERGY

- ◉ Matter- anything that takes up space and has mass
- ◉ Energy- ability to make matter move
  - Light, heat, sound, motion, and electricity

Matter

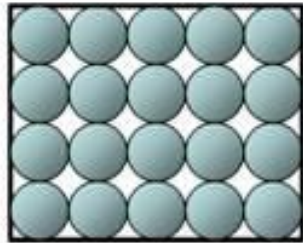


Energy



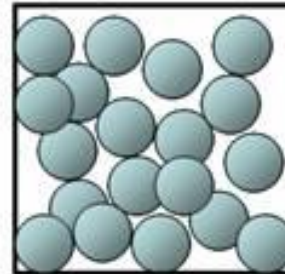
# CLASSIFYING MATTER

- As a state of matter
- It can be a:
  - Solid - Fixed volume & shape
  - Liquid - Fixed volume
  - Gas - Both volume & shape can change
  - Plasma



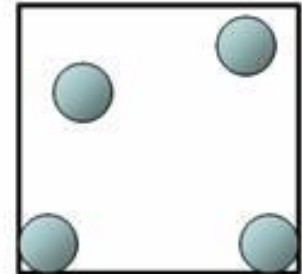
## **Solid State**

Ordered and dense  
Has a definite  
shape and volume.  
Solids are very slightly  
compressible.



## **Liquid State**

Disordered and usually  
slightly less dense.  
Has a definite volume  
and takes the shape of  
the container.  
Liquids are slightly  
compressible.



## **Gas State**

Disordered and  
much lower density  
than crystal or liquid.  
Does not have  
definite shape and  
volume.  
Gases are highly  
compressible.



# REVIEWING STATES OF MATTER

○ Matter can also be in a particular state or phase:

Solid

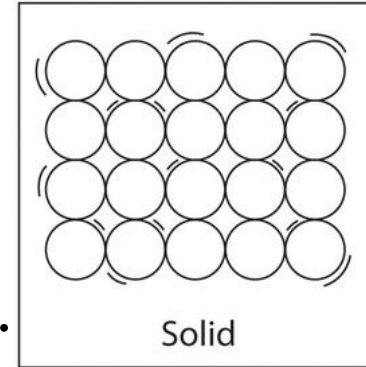
Liquid

Gas

○ Let's review how those atoms are behaving:

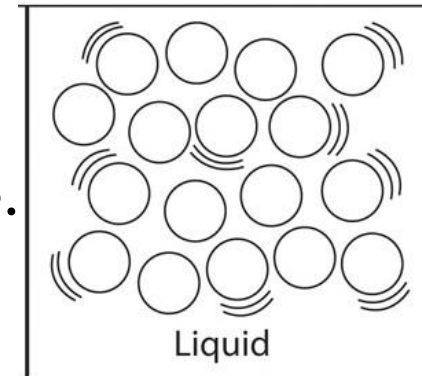
■ Solid

- Atoms are locked together and the matter has a definite volume and shape. Atoms are vibrating/shaking in place.



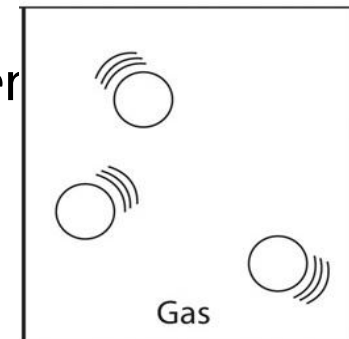
■ Liquid

- Atoms are loosely moving around each other and the matter has a definite volume, but not a definite shape. Atoms are vibrating/shaking as they move around.



■ Gas

- Atoms are moving very quickly everywhere and the matter does not have fixed volume or shape. Atoms are vibrating/shaking as they move around.



# CLASSIFYING MATTER EVEN MORE

- Classification by composition (how are the parts of the matter put together)

Matter can be a  
Pure Substance

-only one  
substance,  
composition is fixed

Example:

- Element
- Compound

Matter can be a  
Mixture

-two ore more  
substances, composition  
is not fixed

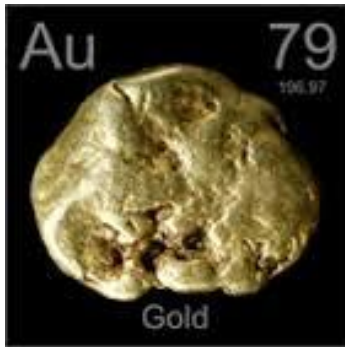
Example:

- Homogeneous Mixture
- Heterogeneous Mixture

# CLASSIFYING MATTER

## ○ Classification by composition:

- Pure Substance - only one substance, composition is fixed
  - Any element (Ex. Gold, hydrogen, oxygen, zinc....)
  - Any Compound (Ex. Water (H<sub>2</sub>O), Salt (NaCl), Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>)
    - Element- A pure substance containing only one type of atom



- Compound- 2 or more different elements bonded together in a fixed composition



NaCl is  
table salt

# CLASSIFYING MATTER

- Most matter you encounter is a mixture
- Classification by composition:
  - Mixture = a combination of two or more substances in which the basic identity of each substance is not changed.
  - Mixture - two or more substances, composition is not fixed (The substances can be separated)
    - Homogeneous (same throughout)
      - Sugar dissolved in water, pudding, milk(at store)
    - Heterogeneous (different throughout)
      - Cereal- Granite, dirt, raisin bran, orange juice



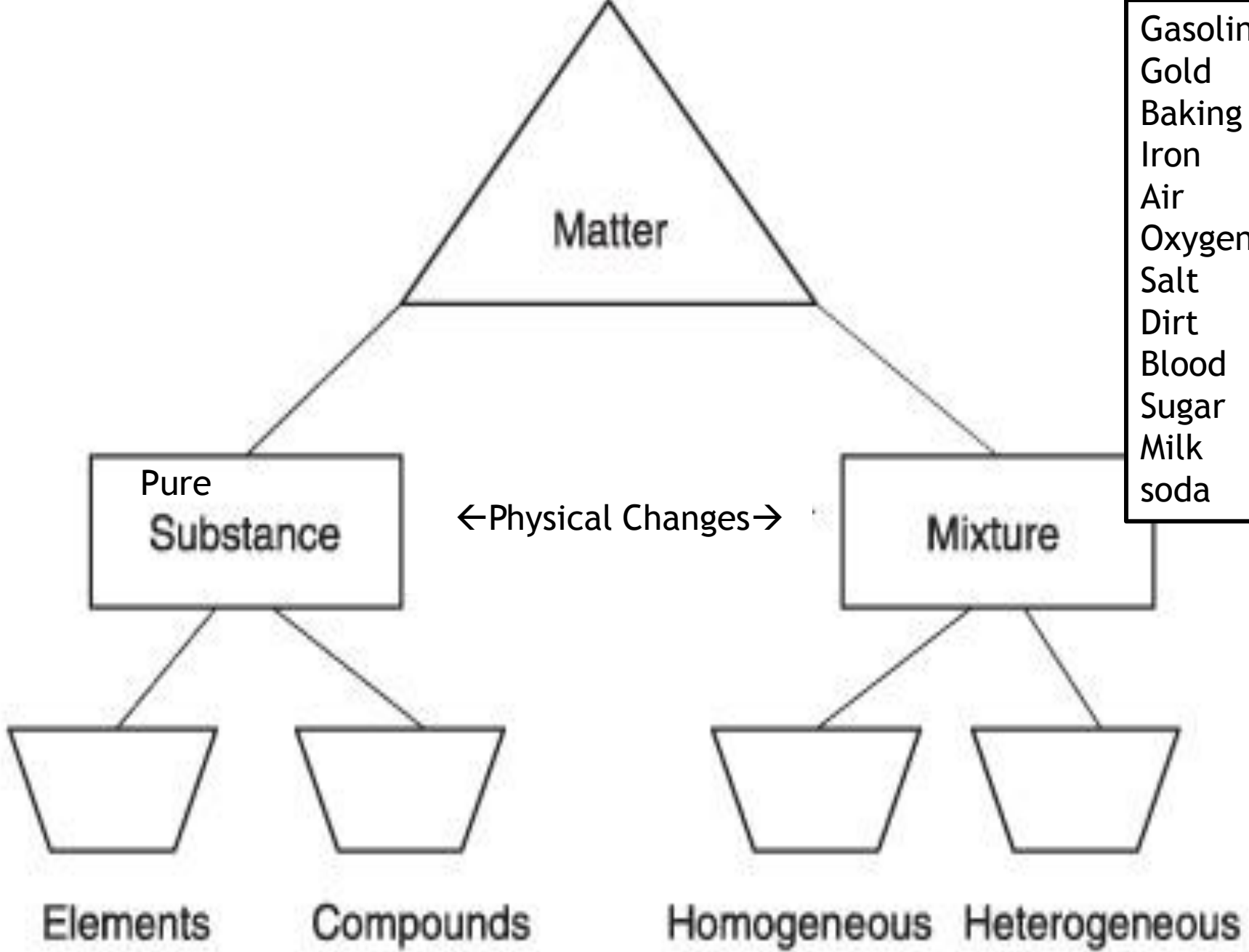
# FEW OTHER THINGS ABOUT MIXTURES

- ◉ A homogeneous mixture is also called a *Solution*
- ◉ *Solution* - a mixture that is the same throughout composed of a solute and a solvent
  - (solute is the lemonade powder mixture and sugar)
  - (solvent is the water)
- ◉ Solute - substance being dissolved
- ◉ Solvent - substance that dissolves the solute



# FEW MORE THINGS ABOUT MIXTURES

- Solutions can be a gas (air), liquid (salt water), or solid (metal alloy)
- Alloys - solid solutions that contain different metals and sometimes nonmetallic substances.
  - Brass, pewter, stainless steel
  - STERLING SILVER is made of silver and copper
- Aqueous solution - solution where the solvent is water



- Gasoline
- Gold
- Baking soda
- Iron
- Air
- Oxygen
- Salt
- Dirt
- Blood
- Sugar
- Milk
- soda



# WHAT TYPE OF MIXTURE IS IT?

Trail Mix



salt water



oil and water



concrete



brass

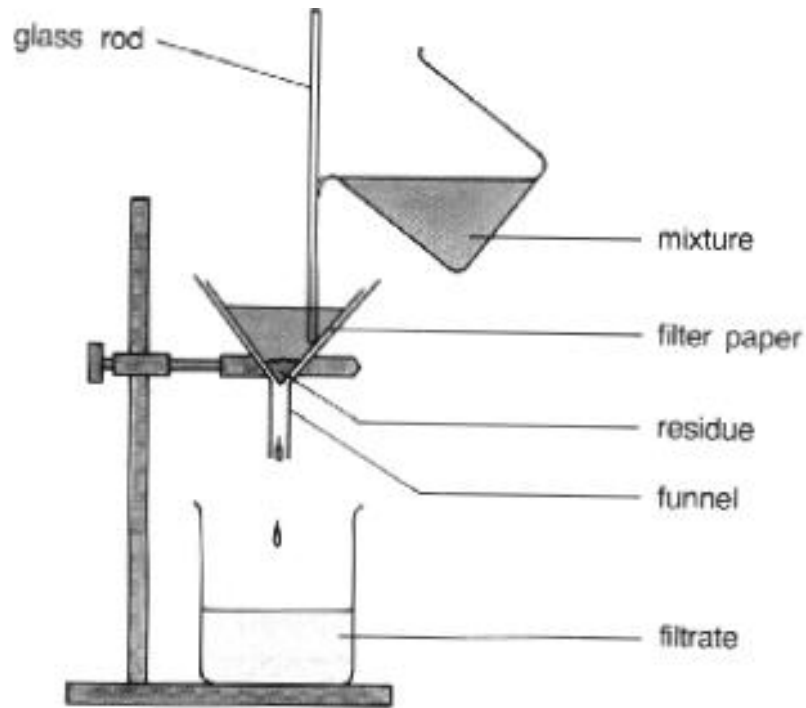


# SEPARATING MIXTURES

- Mixtures CAN be separated into its components by physical changes
- 1<sup>st</sup>- What's a physical change?
  - Physical change - change in matter that does not involve a change in the identity of the substance
- How might you separate a mixture of sand and sucrose (sugar)?

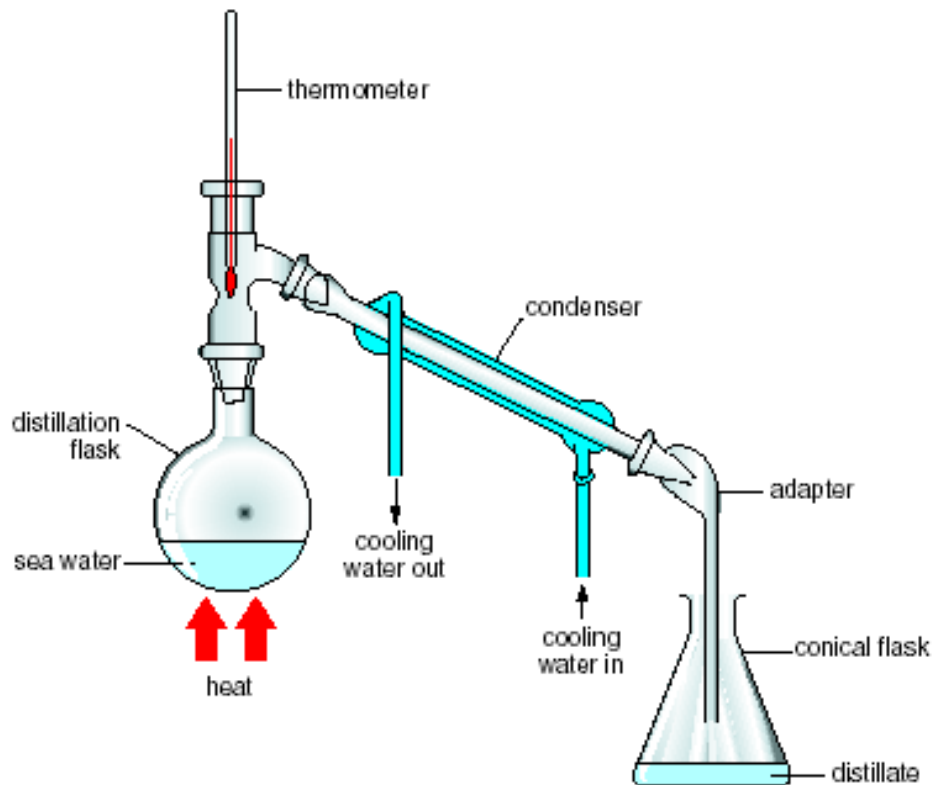
# PHYSICAL WAYS TO SEPARATE MIXTURES

- **Filtration** - used to separate a solid from a liquid



# WAYS TO SEPARATE MIXTURES

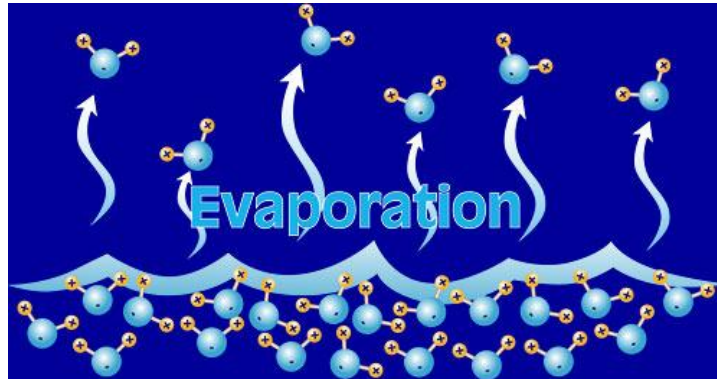
- **Distillation** - used to separate 2 or more liquids or a dissolved solid from a liquid



Distillation

# OTHER EXAMPLES

- **Evaporation** - remove a liquid from a solid



- **Crystallization** - get a pure solid out of a liquid



# HOW ARE THE PARTICLES ARRANGED?

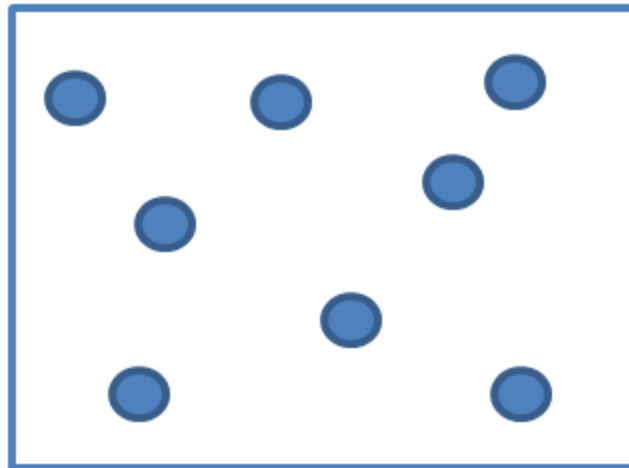
- Remember that matter can be a(n):
  - Element
  - Compound
  - Mixture
  
- So how are the particles arranged?
- Let's practice drawing them.....

# ELEMENT ATOM ARRANGEMENT:

## ⦿ Element:

- One type of atom (this is a pure substance)
- Example:
  - -Atom of hydrogen

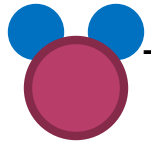
## ⦿ Should look something like this:



# COMPOUND ATOM ARRANGEMENT:

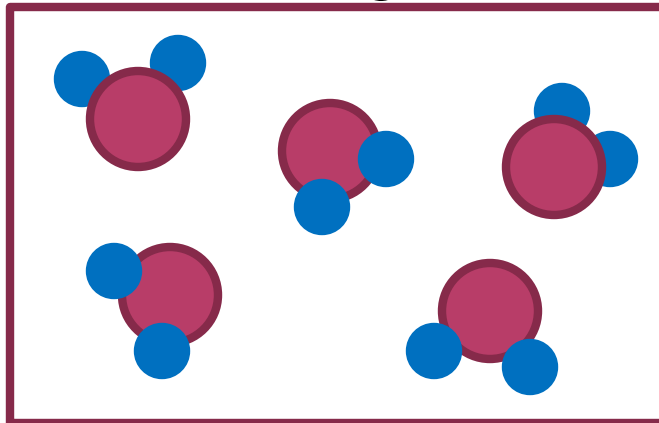
## ⦿ Compound:

- 2 more types of atoms bonded together (makes a pure substance)
- Example:



- Hydrogen and oxygen bonded together (makes water!)

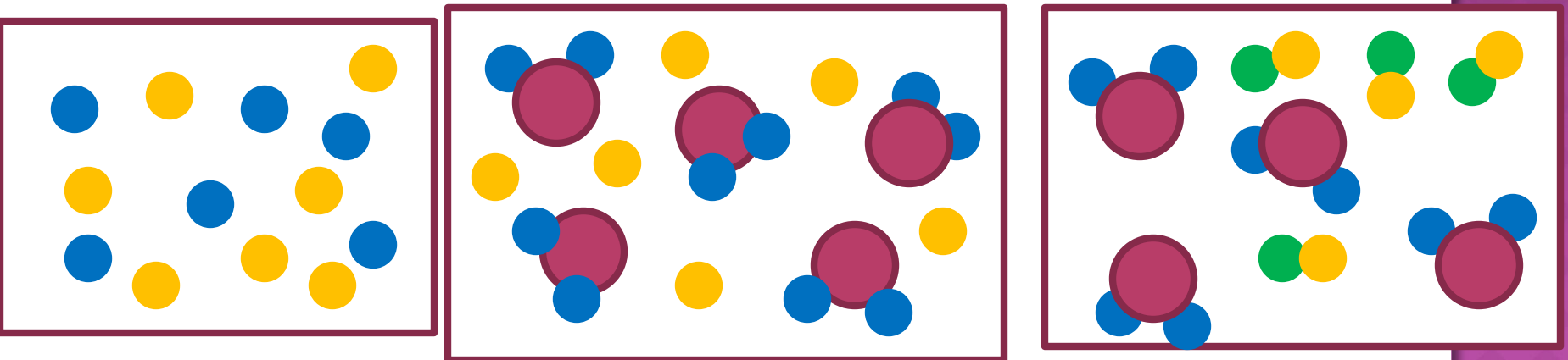
## ⦿ Should look something like this:



# MIXTURE ATOM ARRANGEMENT:

## ⦿ Mixture:

- Two or more pure substances mixed together (can be separated by a physical means)
- Example:
  - Elements mixed together
  - Elements and compounds mixed together
  - Compounds mixed together





# REVIEWING STATES OF MATTER

○ Matter can also be in a particular state or phase:

Solid

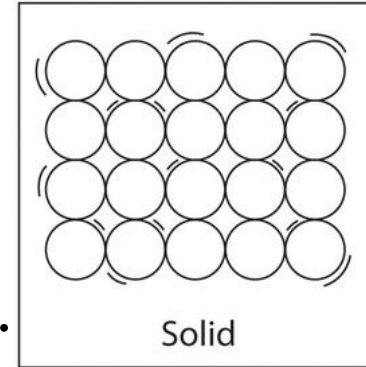
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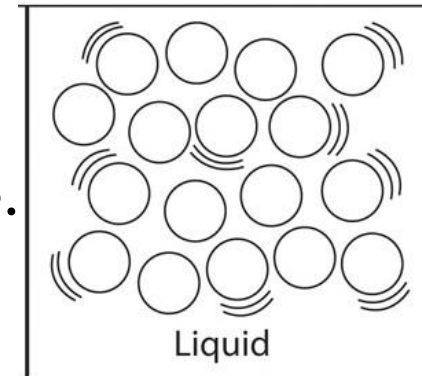
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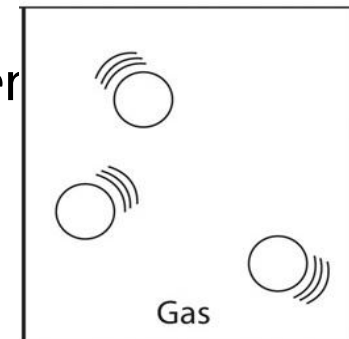
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# ST. 6 PROPERTIES OF MATTER

## OBJECTIVES

- ① 1) Physical vs Chemical properties
- ② 2) Physical vs Chemical changes
- ③ 3) Law of Conservation of Mass

# ST. 6- PROPERTIES OF MATTER

## DETAILED OBJECTIVES:

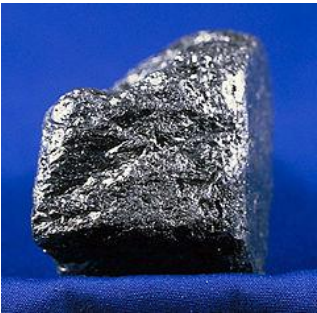
- Is able to apply the Law of Conservation of Mass to chemical and physical changes.
- Is able to identify substances based on their physical and chemical properties
- **Recognizes or recalls specific terminology such as:** physical change, chemical change, law of conservation of mass, chemical property, physical property
- **Performs basic processes, such as:**
  - Distinguish between chemical and physical changes
  - Classify properties of matter as chemical or physical

# STRUCTURE OF MATTER

- ◉ The structure of matter is its composition and how it is organized.

Example Carbon:

graphite



coal



diamond



- ◉ Properties describe the characteristics and behavior of matter, including changes that it undergoes.
- ◉ Properties can be physical or chemical.

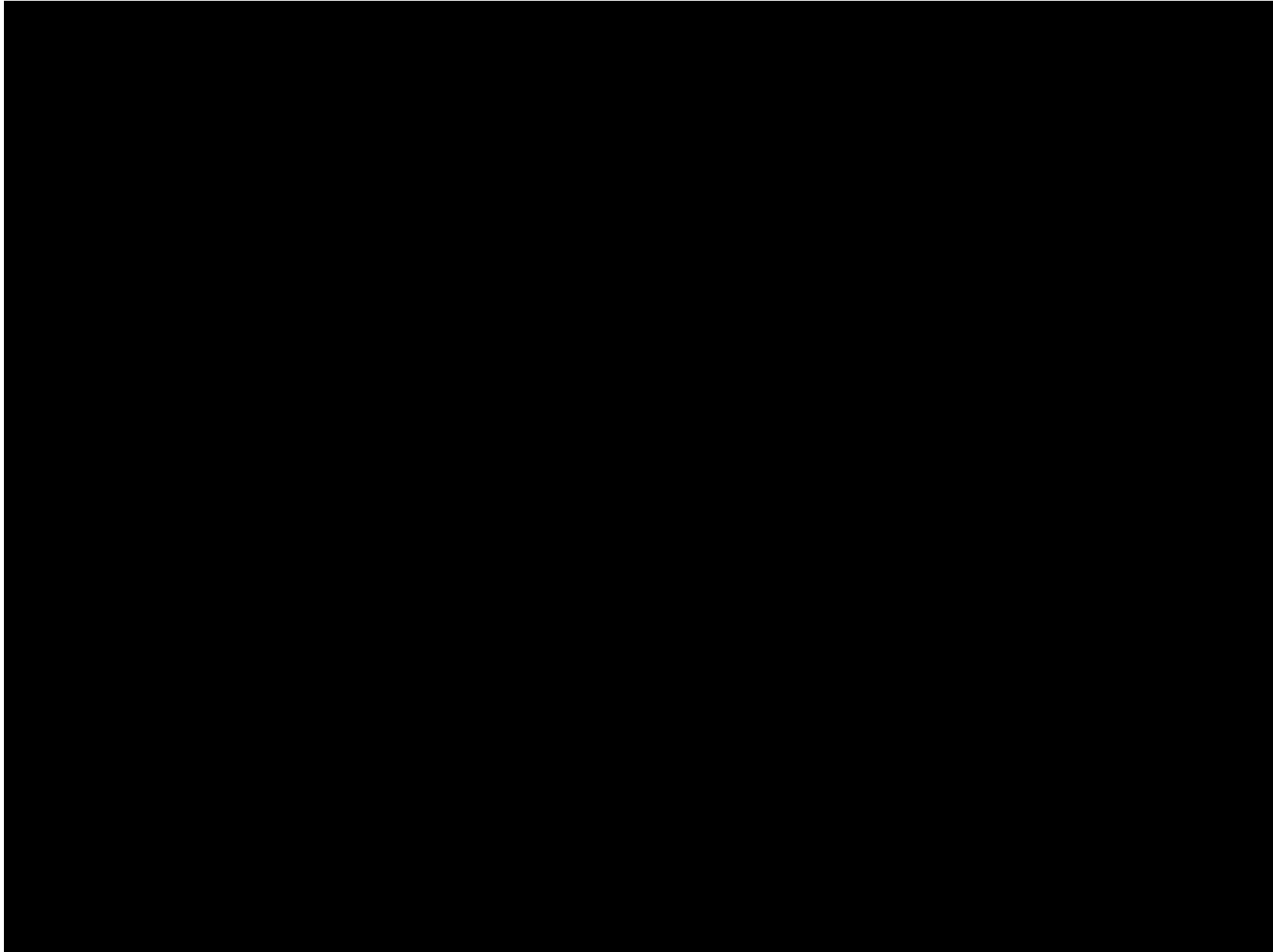
# PHYSICAL AND CHEMICAL PROPERTIES

- Physical Property-anything that can be observed without changing the identity (the chemical nature) of the substance.
- Chemical Property-describes the way a substance may change or react to form other substances.

## Why are we talking about this?

*The more properties we can identify for a substance, the better we know the nature of that substance. These properties can then help us model the substance and thus understand how this substance will behave under various conditions.*

# PROPERTIES OF VIOLIN MAKING



# PHYSICAL VS CHEMICAL PROPERTY EXAMPLES

## Physical Properties

Ways to describe matter:

- color
- smell
- freezing/boiling/melting point
- density
- attraction/repulsion to magnets
- luster
- conductivity
- malleability
- mass
- volume
- shape
- solid
- liquid
- gas

## Chemical Properties

A substance's reactivity:

- heat of combustion
- reactivity with water
- flammability

Basically how does the substance react in the presence of:

- air
- water
- acid
- other chemicals

# PHYSICAL PROPERTIES OF MATTER

- A physical property is something that describes matter
- Examples:
  - Mass
  - Volume
  - Color
  - Smell
  - Attraction or repulsion to magnets
  - Texture
  - Melting & boiling points
  - Viscosity
  - State of the matter (solid, liquid, gas)
  - Density (mass & volume)



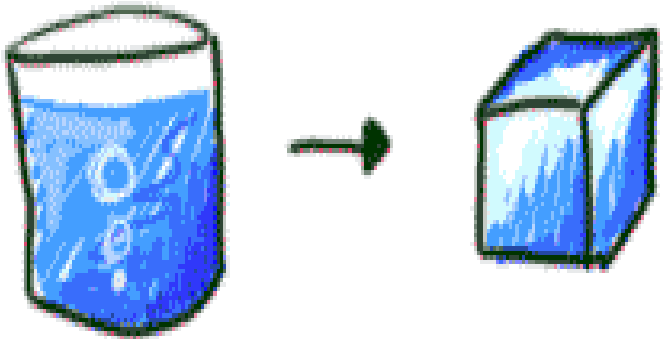
## **Physical Change**

The identity of the substance does not change.  
The change is reversible.

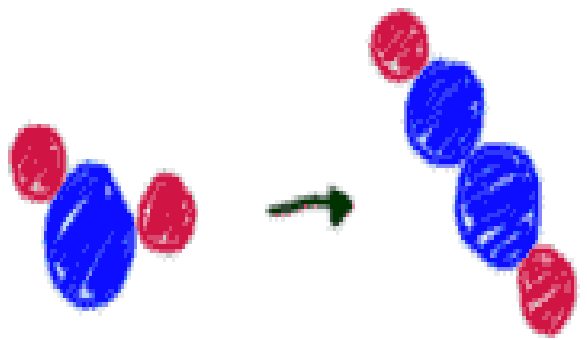
## **Chemical Change**

The identity of the substance changes and a new substance or substances are formed.

# EXAMPLES



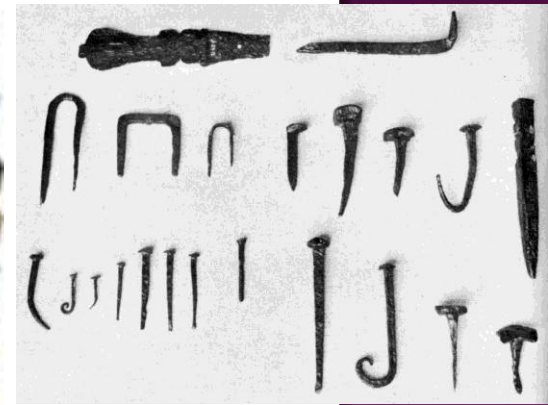
PHYSICAL CHANGE OF WATER INTO ICE



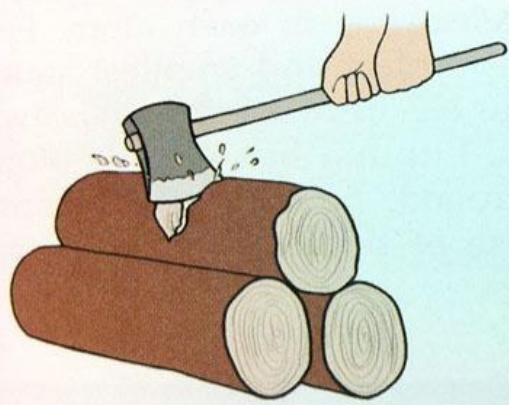
CHEMICAL CHANGE OF WATER INTO HYDROGEN PEROXIDE



THESE PIPES ARE IN THE MIDDLE OF CHEMICAL CHANGES AS THEY RUST.



Physical Change



Chemical Change



Ashes

# WORDS INDICATING A PHYSICAL CHANGE

Cut

Tear

Boil

Melt

Freeze

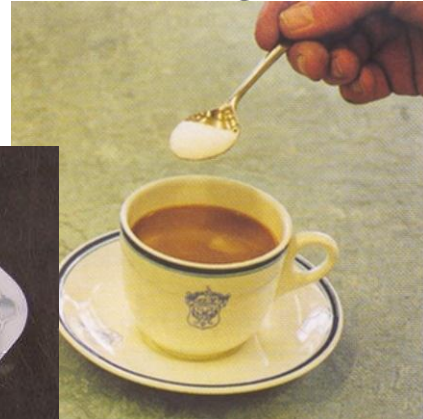
Malleable

Sublimes

Dissolve

Condense

All these words describe a physical change.



# WORDS INDICATING A CHEMICAL CHANGE

Decompose

Explode

Rust

Oxidize

Corrode

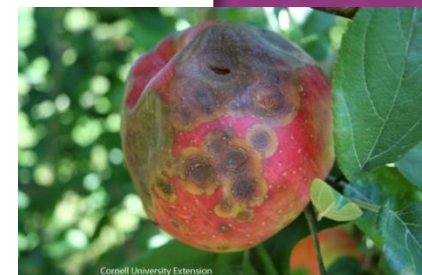
Tarnish

ferment

Burn

Rot

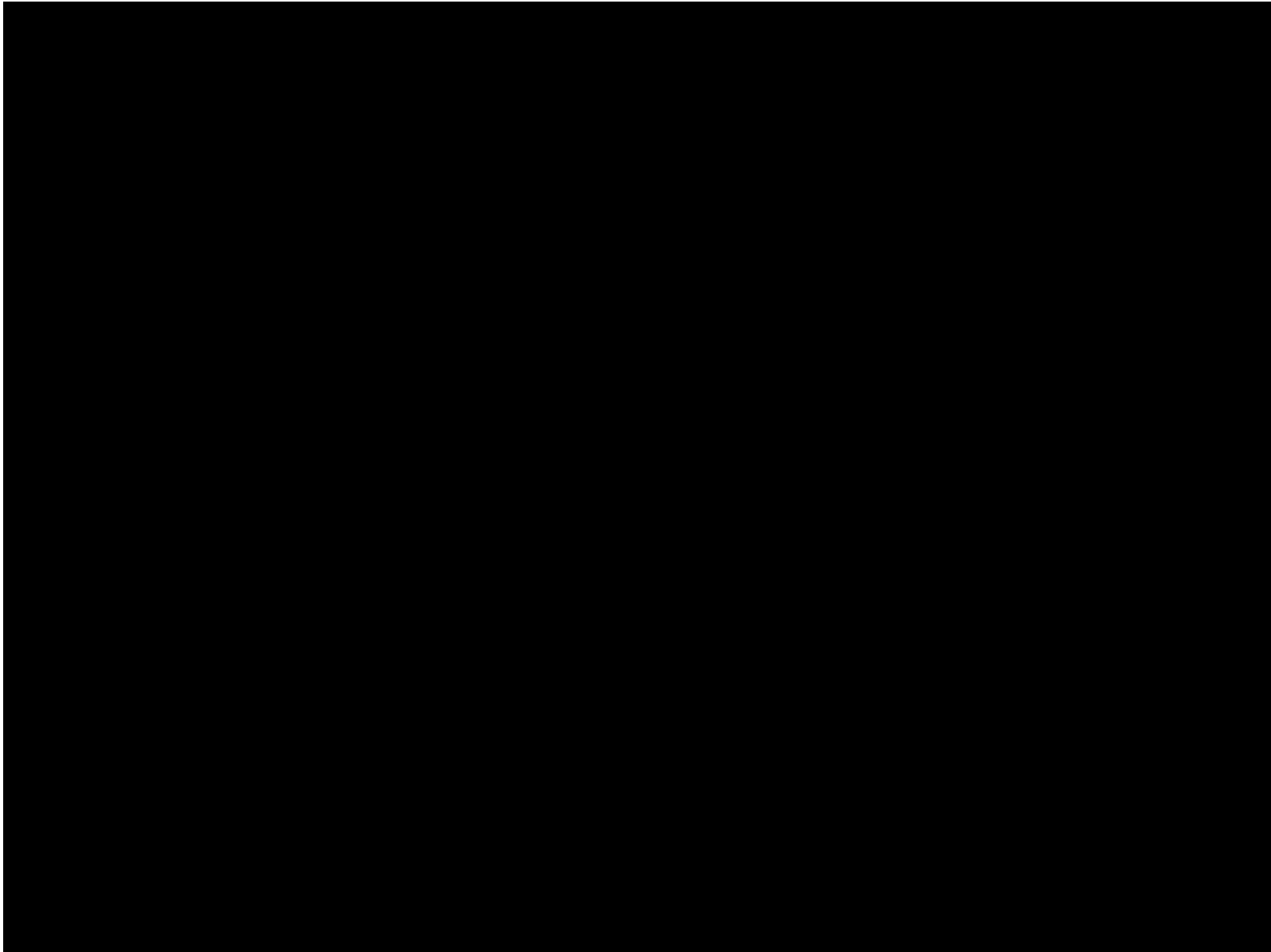
All these words describe a chemical reaction.



# PRACTICE: PHYSICAL OR CHEMICAL?

- Water boils at 100°C.
- Diamonds are capable of cutting glass.
- Water can be separated by electrolysis into hydrogen and oxygen.
- Sugar is capable of dissolving in water.
- Vinegar will react with baking soda.
- Yeast acts on sugar to form carbon dioxide and ethanol.
- Wood is flammable.
- Aluminum has a low density.
- Ammonia is a gas at room temperature.
- Bromine has a red color.
- Dry ice (solid carbon dioxide) sublimates at room temp.
- Salt is dissolved in water.
- Iron rusts in a damp environment
- Gasoline burns in the presence of oxygen.
- Hydrogen peroxide decomposes to water and oxygen.

# ROASTING THE BEANS



# LAW OF CONSERVATION OF MASS: ATOMS AND CHEMICAL CHANGE

- All matter is made of atoms.
- Any chemical change involves a rearrangement of atoms.
- Atoms do not just appear or disappear.
- Law of Conservation of Mass/Matter*
  - Matter is neither created nor destroyed. The atoms are just transferred into a new combination.

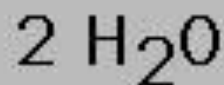
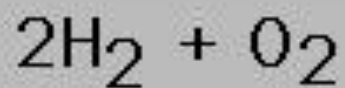
IN THE VIDEO, WATCH WHAT THE  
ATOMS DO:

- Law of Conservation of Mass

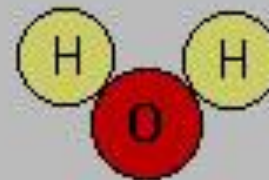
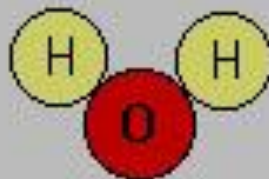


## Law of conservation of mass:

“During a chemical rxn, atoms are neither created nor destroyed. The number of atoms remains constant throughout the reaction. Since the number of atoms doesn't change, the mass must remain constant as well”.

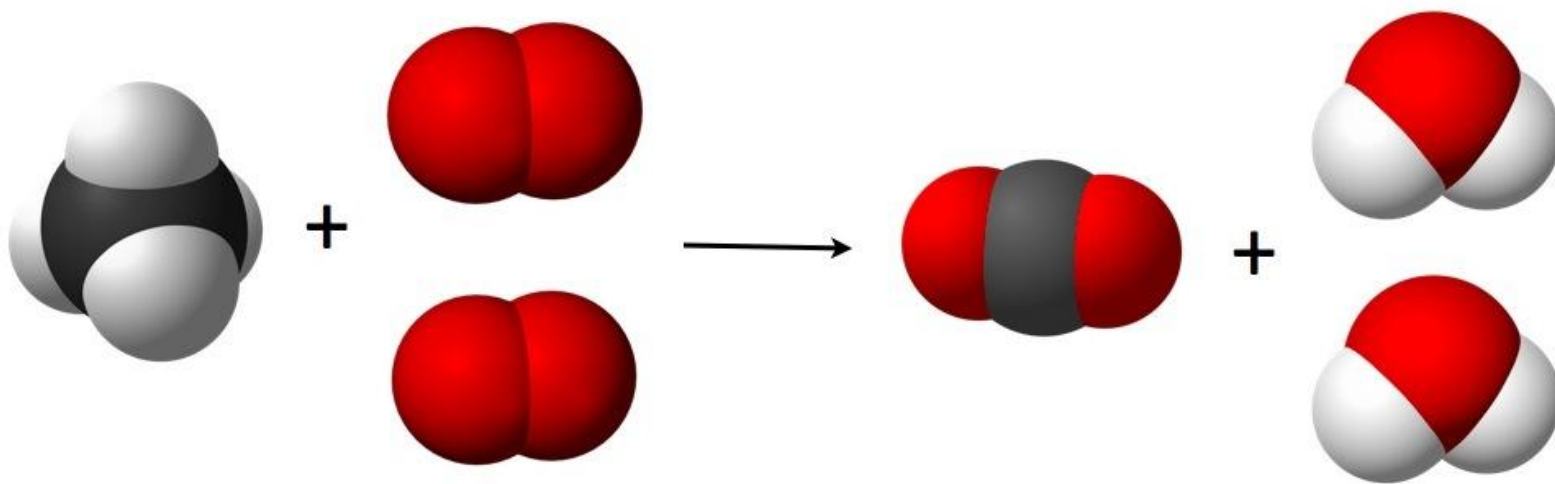






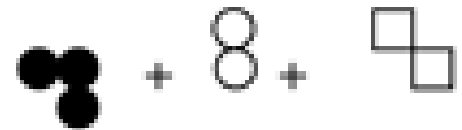

+



4 hydrogen atoms  
+ 2 oxygen atoms

4 hydrogen atoms  
+ 2 oxygen atoms



	Reactants	Products
I		
II		
III		
IV	