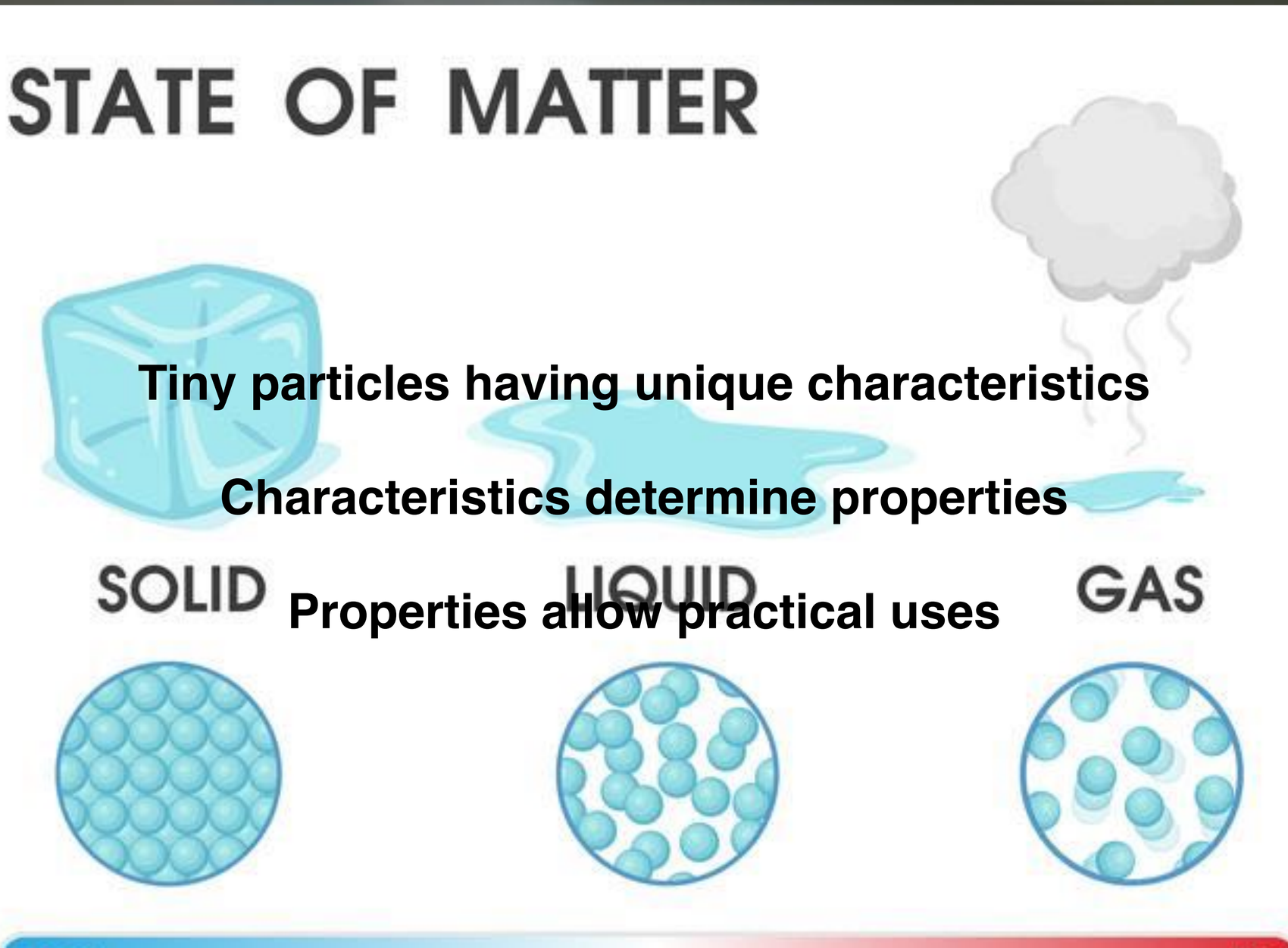
States & Properties of Matter

Unit 1 - Topics 2 & 3

What do you think Chemistry is?



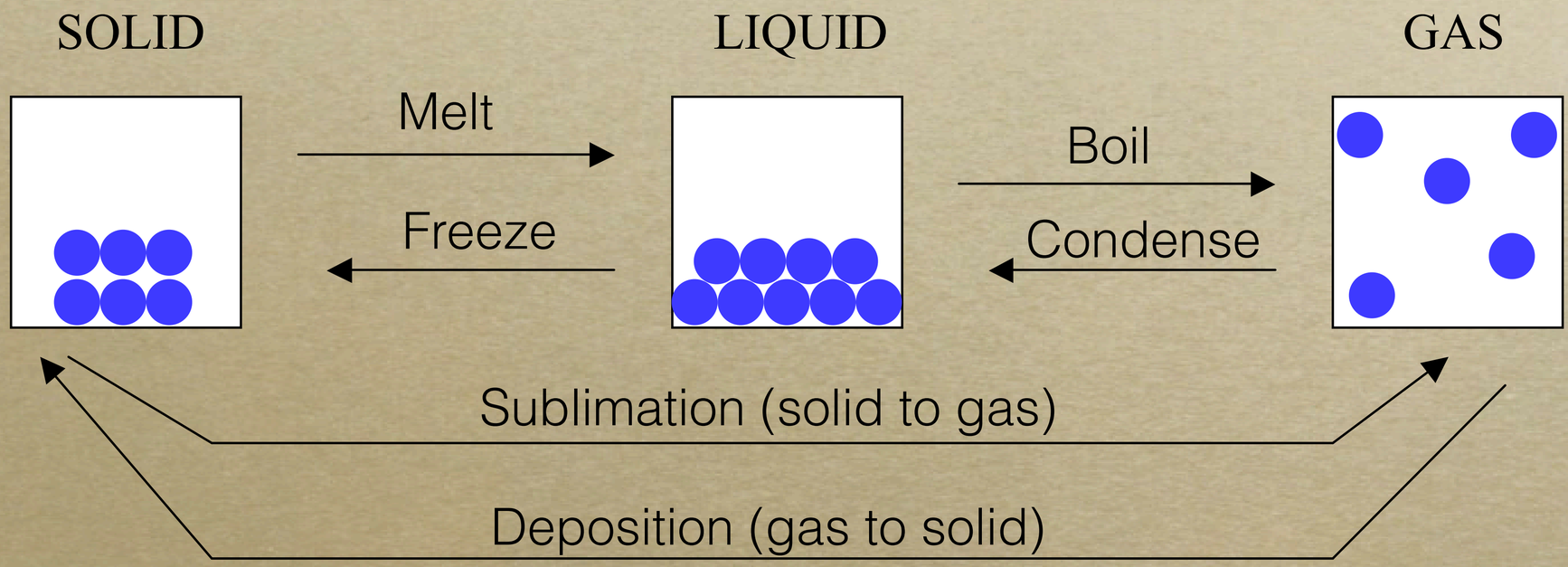
Tiny particles having unique characteristics

Characteristics determine properties

Properties allow practical uses

Particle Diagrams

A way to help visualize states of matter



States of Matter

Properties	Solids	Liquids	Gases
Particles			
Shape			
Volume			
Forces			
Density			
Energy			

Introduction to your Chemistry Reference Tables

Table A - Standard Temperature & Pressure (STP)

Table A
Standard Temperature and Pressure

Name	Value	Unit
Standard Pressure	101.3 kPa 1 atm	kilopascal atmosphere
Standard Temperature	273 K 0°C	kelvin degree Celsius

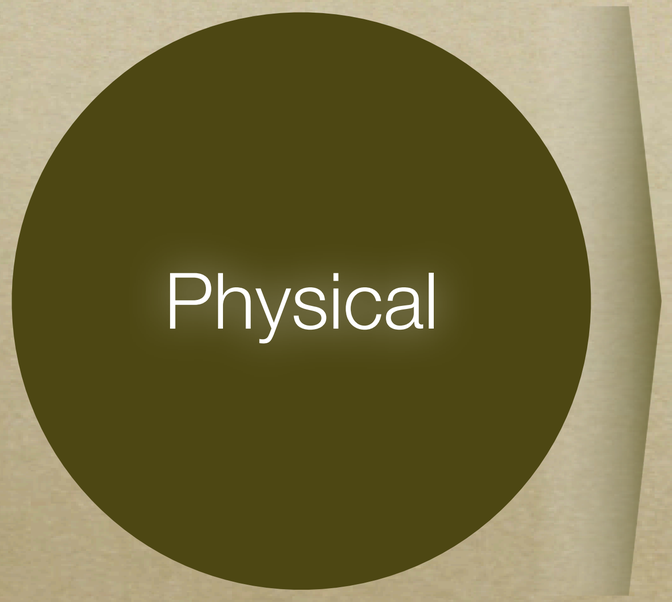
Can be used in tandem with **Table S** to determine states of matter of elements

STP - *Practice*

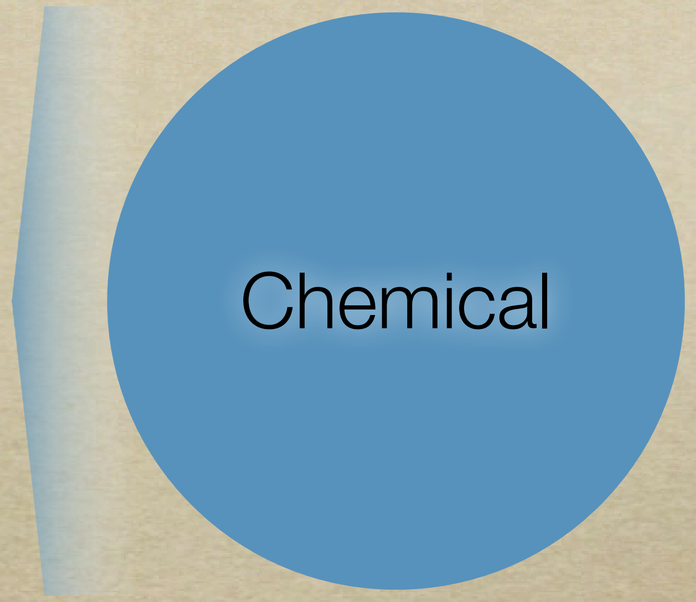
Substance	Color	Melting Point (˚C)	Boiling Point (˚C)
Bromine	Red-Brown	-7	59
Chlorine	Green-Yellow	-101	-34
Ethanol	Colorless	-117	78
Mercury	Silvery-White	-39	357
Neon	Colorless	-249	-246
Sulfur	Yellow	115	445
Water	Colorless	0	100

1. Which colorless substance is a liquid at -30 ˚C? Ethanol
2. Which colorless substance is a gas at 60 ˚C? Neon
3. Which substance is a solid at 7 ˚C? Sulfur
4. Which element is a liquid when mercury boils? Sulfur

Physical vs. Chemical Properties



- Can be determined without changing the substance
- Density, color, hardness, state of matter (solid, liquid, gas), odor



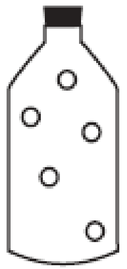
- Can only be identified by a chemical change (new substance formed)
- Fire, react, neutralize, combust

Regents Practice

Which element is a solid at STP?

(1) H_2
(2) I_2
(3) N_2
(4) O_2

Which diagram best represents a gas in a closed container?



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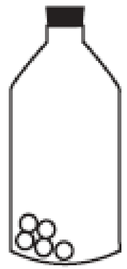

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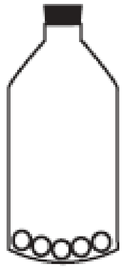

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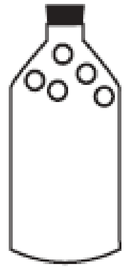


(4)

Regents Practice

Which statement best describes the shape and volume of an aluminum cylinder at STP?

(1) It has a definite shape and a definite volume.
(2) It has a definite shape and no definite volume.
(3) It has no definite shape and a definite volume.
(4) It has no definite shape and no definite volume.

Which statement describes a chemical property of the element magnesium?

(1) Magnesium is malleable.
(2) Magnesium conducts electricity.
(3) Magnesium reacts with an acid.
(4) Magnesium has a high boiling point.

Which element is a metal that is in the liquid phase at STP?

(1) bromine
(2) cobalt
(3) hydrogen
(4) mercury

Regents Practice

Which property could be used to identify a compound in the laboratory?

(1) mass
(2) melting point
(3) temperature
(4) volume

Which statement describes a chemical property of bromine?

(1) Bromine is soluble in water.
(2) Bromine has a reddish-brown color.
(3) Bromine combines with aluminum to produce $AlBr_3$.
(4) Bromine changes from a liquid to a gas at 332 K and 1 atm.

Which element has the greatest density at STP?

(1) scandium
(2) selenium
(3) silicon
(4) sodium

Regents Practice

Which statement describes a chemical property that can be used to distinguish between compound *A* and compound *B*?

(1) *A* is a blue solid, and *B* is a white solid.
(2) *A* has a high melting point, and *B* has a low melting point.
(3) *A* dissolves in water, and *B* does not dissolve in water.
(4) *A* does not burn in air, and *B* does burn in air.

Given the particle diagram:

At 101.3 kPa and 298 K, which element could this diagram represent?

(1) Rn
(2) Xe
(3) Ag
(4) Kr

Regents Practice

Which statement describes a chemical property of hydrogen gas?

(1) Hydrogen gas burns in air.
(2) Hydrogen gas is colorless.
(3) Hydrogen gas has a density of 0.000 09 g/cm^3 at STP.
(4) Hydrogen gas has a boiling point of 20. K at standard pressure.

Which element has the greatest density at STP?

(1) calcium
(2) carbon
(3) chlorine
(4) copper

Which element is a liquid at STP?

(1) argon
(2) bromine
(3) chlorine
(4) sulfur

Mixtures

Topic 3 - Homogeneous vs. Heterogeneous

Vocabulary

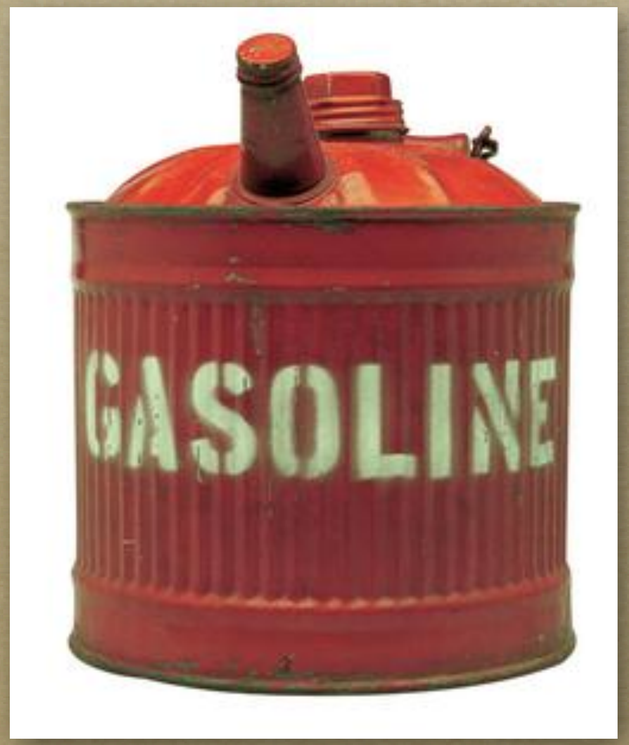
Substance:

- matter that has a uniform and definite composition. Sometimes they are *pure* substances.
  - *Examples*: H_2O, NaCl, Cu (Compounds & Elements)

Mixtures

Homogeneous:

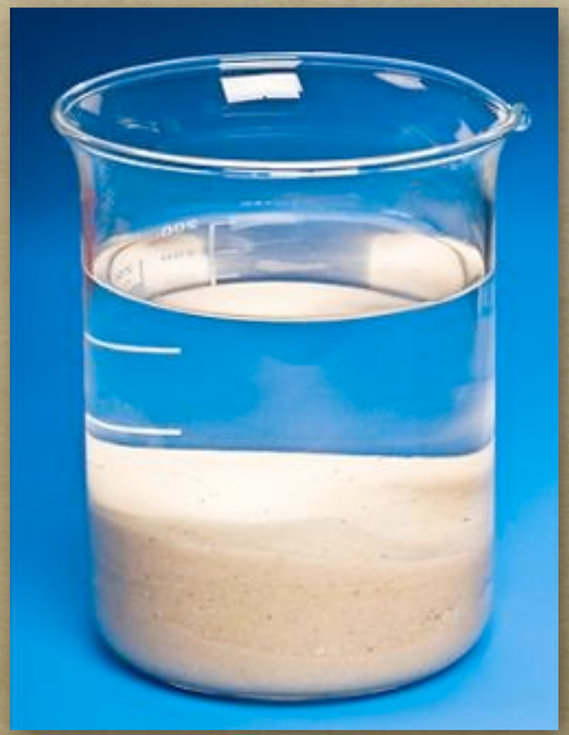
- pure substances distributed evenly throughout the mixture.
- *Uniformly blended*
  - *Examples*: gasoline, syrup, air

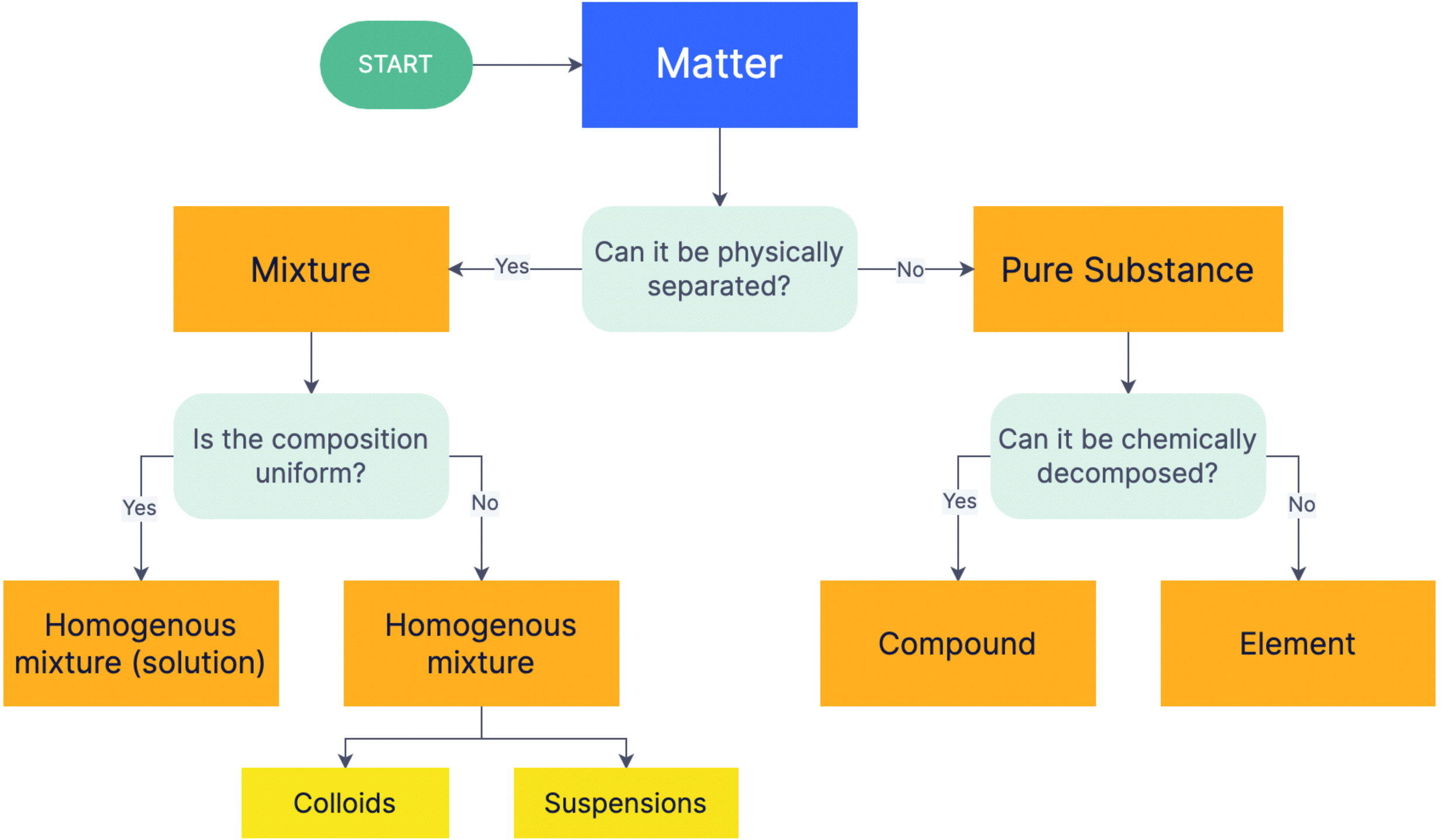


Mixtures

Heterogeneous:

- substances that are not evenly mixed.
- *Non-uniformly blended.*
  - *Examples*: sand & water, chocolate chip ice cream




START
Matter
Can it be physically separated?
Yes
Mixture
No
Pure Substance
Is the composition uniform?
Yes
No
Homogenous mixture (solution)
Homogenous mixture
Colloids
Suspensions
Can it be chemically decomposed?
Yes
No
Compound
Element

Regents Practice

Recovering the salt from a mixture of salt and water could best be accomplished by

(1) evaporation
(2) filtration
(3) paper chromatography
(4) density determination

Which must be a mixture of substances?

(1) solid
(2) liquid
(3) gas
(4) solution

Regents Practice

When a mixture of water, sand, and salt is filtered, what passes through the filter paper?

(1) water, only
(2) water and sand, only
(3) water and salt, only
(4) water, sand, and salt

A beaker contains both alcohol and water. These liquids can be separated by distillation because the liquids have different

(1) boiling points
(2) densities
(3) particle sizes
(4) solubilities