

A 5.0 mL sample of a hydrocarbon (with molecular formula C_6H_{14}) has a mass of 3.2745 g (measured on a balance). What is the density?

- Listed are 4 hydrocarbons that all have the formula C_6H_{14} , but they differ in how all the C and H atoms are connected (isomers). All are liquids at room temperature but have slightly different densities.
- Can you identify the liquid?

Hydrocarbon (C_6H_{14})	Density (g/mL)
n-hexane (A)	0.6600
2,3-dimethylbutane (B)	0.6616
2,2-dimethylbutane (C)	0.6485
2-methylpentane (D)	0.6645

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Example 1 Part 2: What if you used a more precise graduated cylinder and determined the volume to be 4.93 mL?

Steps for Dimensional Analysis Problems

1. Sort information (given, find)
2. Plan a “map” for unit conversion
3. Set up - begin with given quantity and unit
4. Multiply by the conversion factor(s) needed to cancel unwanted units and leave unit required for the desired solution
5. Check yourself!

Density as a Conversion Factor- helps convert between mass and volume of the same substance

Ex. 2: Mercury is one of the most dense liquids at room temperature. How much does a 1.2 L sample weigh in grams if the density is 13.56 g/mL.



Ex. 3: Units raised to a power?

Typical pressure for optimal performance of automobile tires is 32 lb/inch². What is this pressure in kg/m²?

$$1 \text{ lb} = 453.59 \text{ g} \qquad 1 \text{ inch} = 2.54 \text{ cm}$$



Ex. 4:

Imagine a large number of sulfur atoms placed end to end like beads on a string. Each atom has a diameter of 206 pm and 1.00×10^{19} sulfur atoms have a mass of 5.3×10^{-4} g. Calculate the mass of the sulfur atoms (in kg) that would stretch from the earth to the sun, a distance of 1.496×10^8 km.

Chapter 1

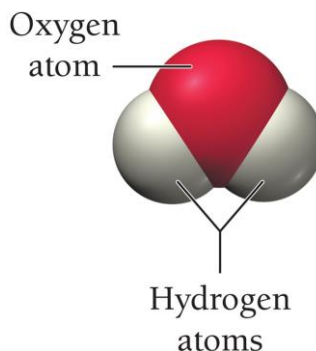
I. Chemistry is the study of matter...

A. Atom vs. Molecule

Atom: the basic particles that compose ordinary matter

Molecules: more than one atom bound together in a specific geometrical arrangement.

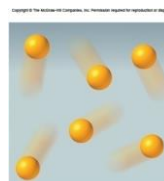
Water molecule



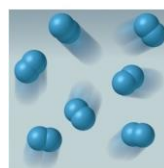
B. Substance- form of matter that has a definite (constant) composition

Types of substances

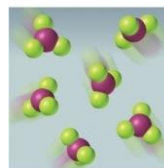
- **Elements**- a substance that cannot be separated into any simpler substances (only one type of atom)
 - Ex: argon (Ar), nitrogen (N_2)
- **Compounds**- substance made up of more than one type of element/atom, but only one substance
 - Cannot be separated further by physical means
 - Ex: H_2O



(a)



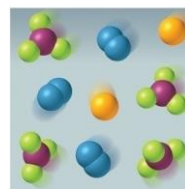
(b)



(c)

C. **Mixtures**- combination of two or more substances

- CAN be separated by physical means



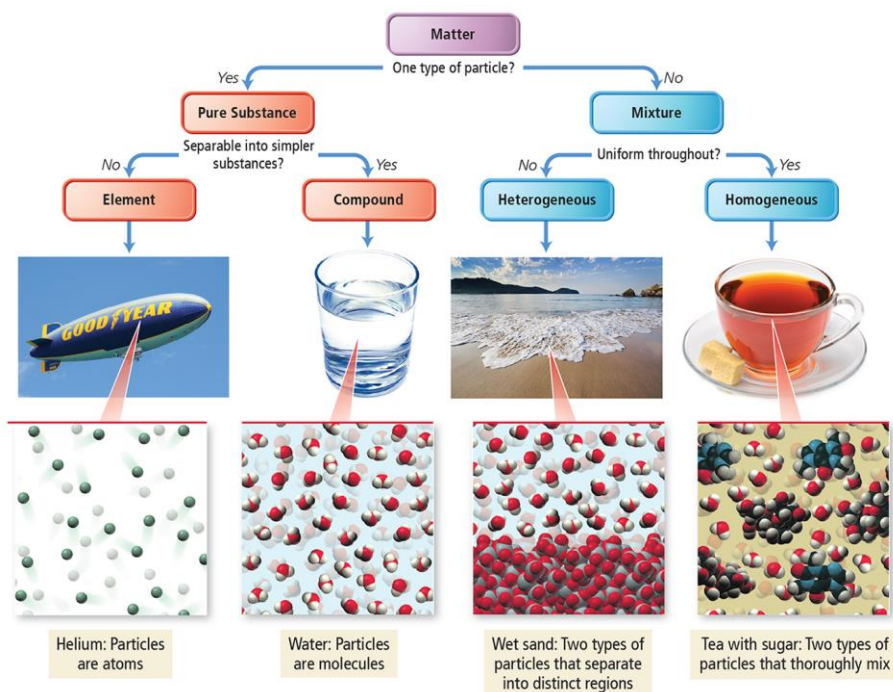
(d)

Types of Mixtures

- **Homogeneous mixture**-
composition of mixture is uniform,
constant throughout

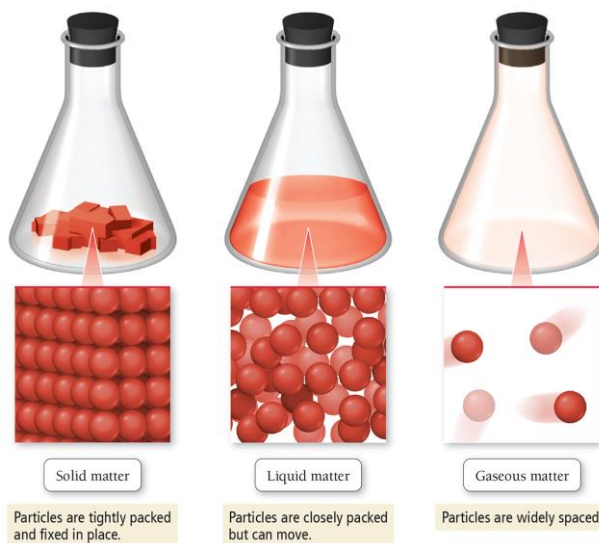


- **Heterogeneous mixture**-
composition is not uniform



D. States of Matter

- States of matter- substances can exist as a solid, liquid or gas

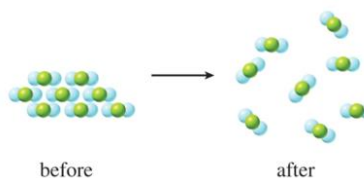


E. Properties of Matter

1. Physical Vs. Chemical Properties

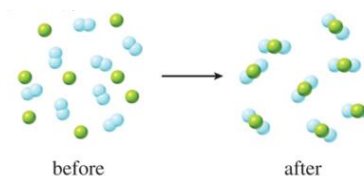
Physical- can be observed or measured without changing the identity of a substance

ex. measuring the mp of a substance



Chemical- must carry out a chemical change to observe

Ex. Hydrogen burns in oxygen gas to form water



E. Properties of Matter

2. Extensive vs. Intensive properties

Extensive- depends on the amount or size of substance, these properties are additive

Ex. Mass, length

Intensive- independent of the amount of substance, remains the same regardless of sample size, can be used to identify substances

Ex. Melting point, boiling point, density