

Chapter 2

Matter

Chemistry

- The study of matter and how it changes
- Matter – anything that has mass and takes up space
- Mass – resistance to change in motion
- Two types of matter-
 - Substance- Pure
 - Mixture- more than one substance

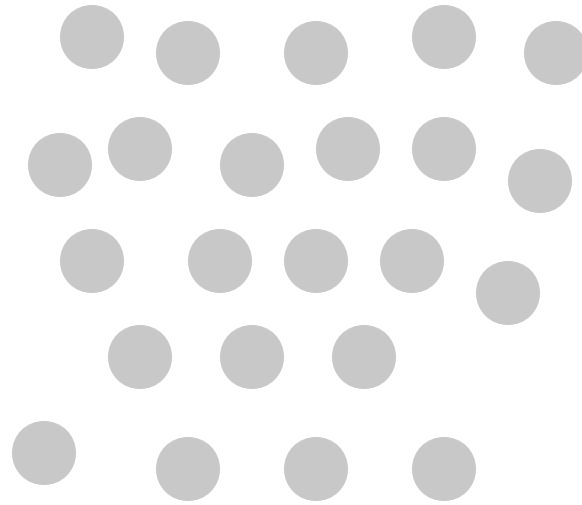
Two Kinds of Substances

- Elements- Simplest kind of matter
 - Can't be broken down further
 - All one kind of atom
 - 116 kinds of elements
 - Each has a 1 or two letter symbol
 - Each behaves differently
 - Everything else is built of them

Two Kinds of Substances

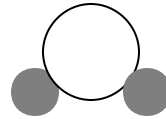
- Compounds- Made of two elements chemically combined
 - Atoms stick together to make molecules
 - All molecules of a compound are the same
 - **They mix in the same ratio**
- Compounds behave completely differently from the elements that make them

Elements and Compounds



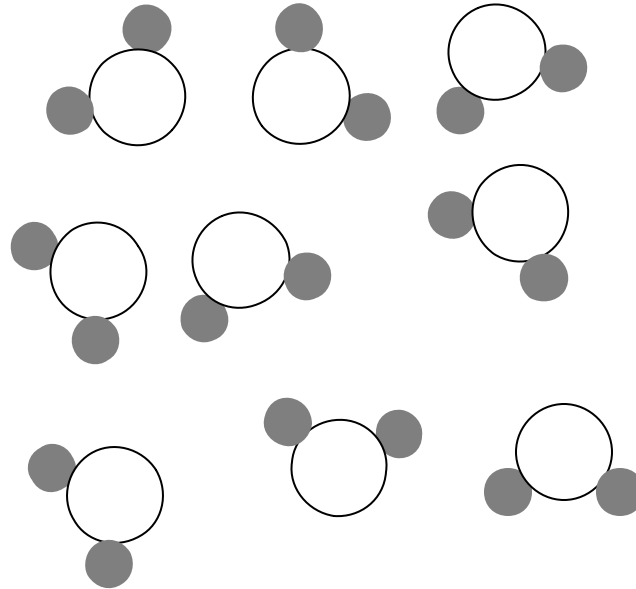
Element-
All one atom

Elements and Compounds



Molecule-
Different atoms
stuck together

Elements and Compounds

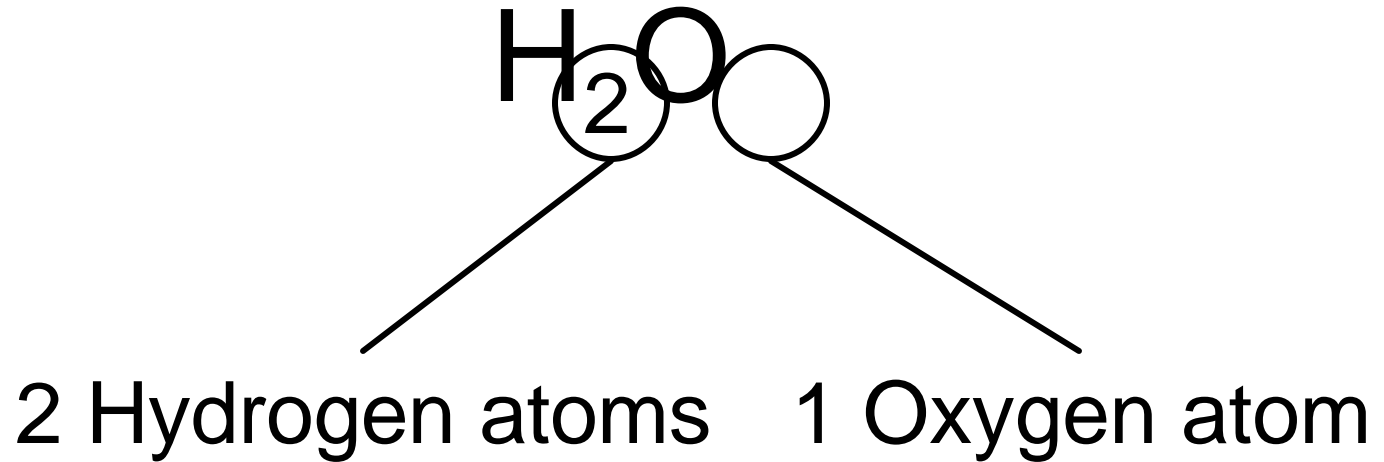


Compound-
All one molecule

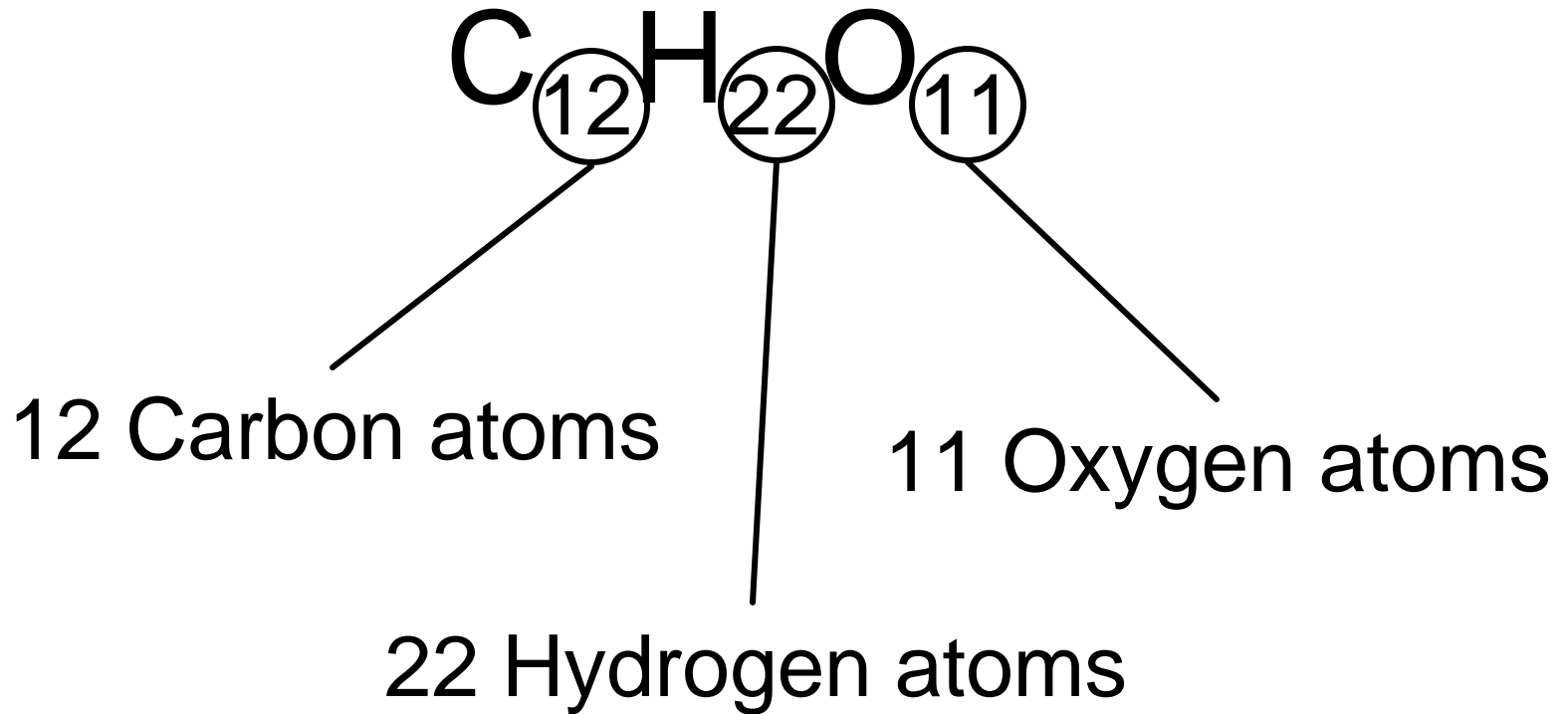
Chemical Formulas

- Tell the type and number of atoms in a molecule
- Symbols tell type
- Subscripts tell number
- Don't write one as a subscript

Chemical Formulas



Chemical Formulas



Molecules

- Most molecules form from different kinds of atoms
- A few elements form molecules too
 - O_2
 - N_2
 - H_2
 - Cl_2
 - F_2
 - I_2
 - S_8
 - P_4

Pure Substance

- Elements and compounds
- Only one kind of molecule or atom
- Compounds have specific amounts of their elements
- Compounds are completely different from their elements

Mixture

- Different substances mixed together
- Can be in any proportion
- Keeps the same properties as the things that make it
- Kool-aid
 - Mix something sweet, something wet and something red
 - Get something sweet, wet and red

Two Types of Mixtures

- Heterogeneous-
 - Different from place to place
 - Not evenly mixed
 - Chocolate chip cookie, gravel, soil
- Homogeneous-
 - The same throughout
 - Evenly mixed
 - Kool-aid, sea water, air

Liquid Mixtures

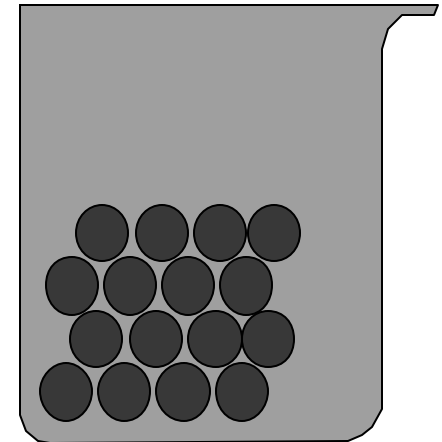
- Miscible-
 - Liquids that do dissolve in each other
 - Homogeneous
 - Gasoline
- Immiscible-
 - Liquids that don't dissolve in each other
 - Heterogeneous
 - Oil and water

Kinetic Theory

- Kinetic means motion
- Three main parts of the theory
 - All matter is made of tiny particles
 - These particles are in constant motion and the higher the temperature, the faster they move
 - At the same temperature, heavier particles move slower.

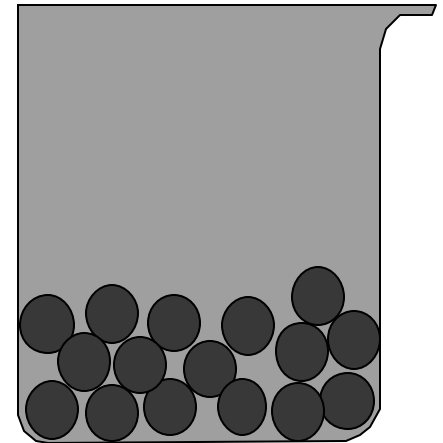
States of Matter

- Solid
- Particles are tightly packed
- Stuck to each other in a pattern
- Vibrate in place
- Can't flow
- Constant volume



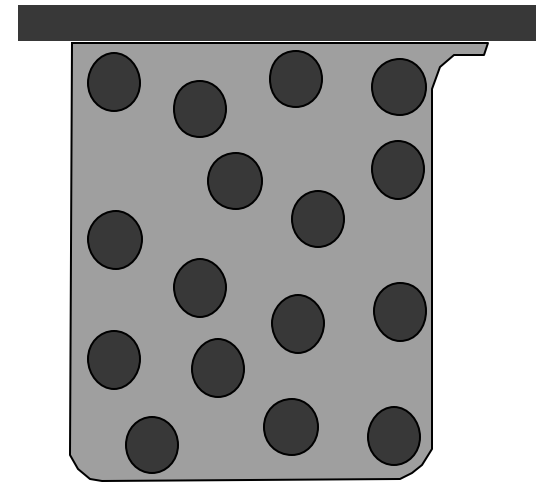
States of Matter

- Liquid
- Particles are tightly packed
- Able to slide past each other
- Can flow
- Constant volume



States of Matter

- Gas
- Particles are spread out
- Flying all over the place
- Can flow
- Volume of whatever container their in



Gases

- Fill the available space
- Particles moving at about 500 m/s
- Particles hitting things cause pressure

Liquids

- Spread out on their own
- Fluids- gases and liquids both flow
- Viscosity- the resistance to flow
- The better the molecules stick to each other, the more resistance

Energy

- The ability change or move matter
- As you add energy to a liquid, the temperature goes up
- The molecules move faster
- Eventually they will move fast enough to break free and become a gas
- This is evaporation- the change from a liquid to gas

Phases Changes

- If you change rapidly enough, the gas will form below the surface and boil
- Condensation- Change from gas to liquid
- As you cool a gas the molecules slow down
- As gas molecules slow down they stick together

Phases Changes

- Molecules and atoms don't change during a phase change
- the composition doesn't change
- The mass doesn't change
- The volume does change
- Only the attractions and motion change

Law of Conservation of Mass

- In all changes, mass cannot be created or destroyed
- All the mass you start with you end with
- It might be hard to count

Law of Conservation of Energy

- In all changes, energy cannot be created or destroyed
- All the energy you put in, you get out
- It might be hard to count

Properties

- A property is a something that describes matter
 - An adjective
 - Used to identify the matter
 - Used to distinguish between different types

Chemical Properties

- Used to describe how substance reacts
- How it changes
 - By combining with other substances
 - Or breaking apart
- Reactivity how a substance combines with other substances
- Things like flammability, rusting, etc.

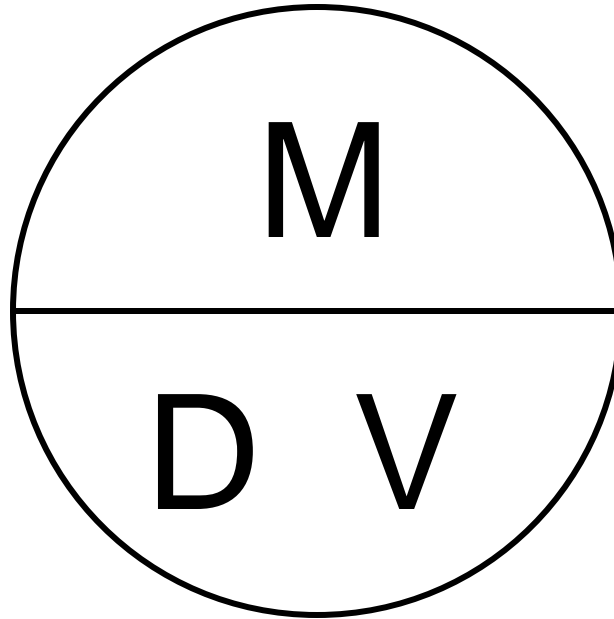
Physical Properties

- Can be observed or measured without changing the composition
- Melting point , boiling point, hardness, odor, ability to conduct electricity and heat
- Density – how heavy something is for its size
- Ratio of mass to volume
- If the density of substance is less than its surroundings, it floats

Density

- Found by dividing the mass by volume
- $D = \frac{m}{V}$
- Units of g/mL or g/cm³
- Water has a density of 1 g/mL

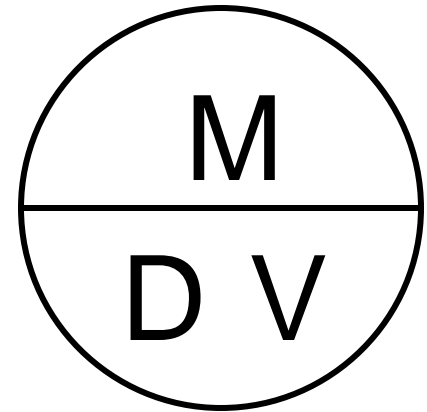
Density



Cover up the one you are looking for to find the formula for the missing piece

Density

- A piece of wood has a mass of 12 g and a volume of 16 cm³. What is its density?
- Steel has a density of 7.8 g/cm³. How much would 56 cm³ of steel weigh?
- What would the volume of the same mass of water be?



Properties

- Allow us to identify substances
- Allow us to separate substances
- Determine uses

Changes

- Two types-
 - Physical Changes- no new type of matter is made
 - All the molecules stay the same
 - Chemical Change- a new type of matter is made
 - Atoms rearrange to make new elements or compounds

Chemical Changes

- Completely new properties
- Products are not at all like the reactants
- Makes new odor, color, etc.

Physical Changes

- Might look a little different
- Keeps original properties
- Changing phases
- Making a mixture
- Cutting
- Grinding
- Dissolving

Dissolving Sugar

- Water molecules break apart and surround sugar molecules
- All the original molecules are still there
- Sugar gets so spread out that they don't block light