MATTER

CHM090 with Dr. Kim
GCC

Three States of Matter: solid, liquid, and gas

Gas: Particles are far apart and are in constant motion.

- **No set shape,** _____
- **No set volume,** _____

Liquid: Particles are touching but are free to flow around one another.

- Liquids assume shape of _____.
- Volume is constant, _____

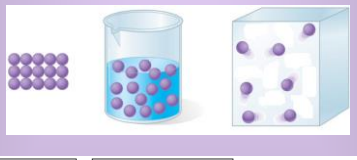
Solid: Particles are packed tightly together & organized in a pattern; the atoms vibrate in place.

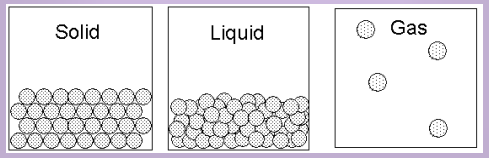
- Solids have a definite, _____.
- Solids have their own _____.

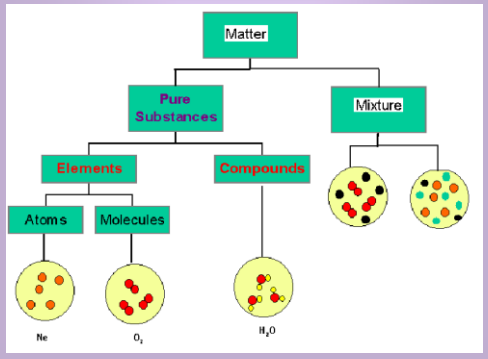
Cool animations

3 States Of Matter – Scroll down and click on all the states of matter animations and the phase change animation (some may not work which is why there are several options)

Ways to Draw the States of Matter



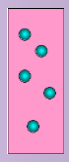




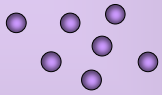
Definitions

- **Element** – one type of atom only,
  - **same groups, same atoms**
- **Compound** – two or more **different** atoms bonded together,
  - **same groups, different atoms**
- **Pure** – all particles are the same
  - **same groups**
- **Mixture**
  - **different groups**

(top picture is _____,
bottom is _____)

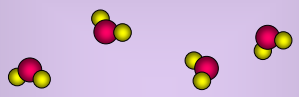


Atoms of an Element

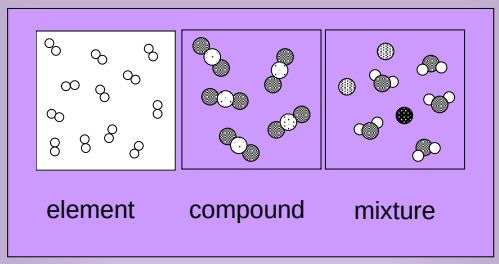


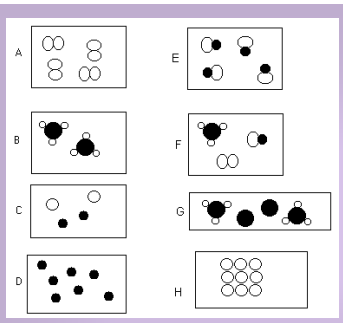
Molecules of an Element

Molecules of a Compound if different



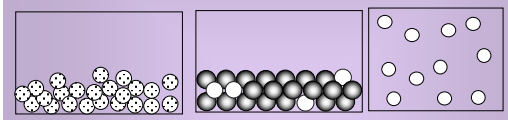
Explain Why?

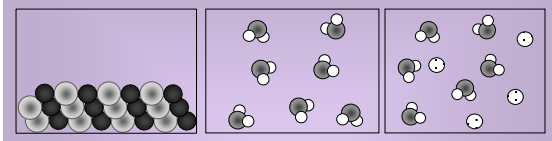




For each figure, indicate if it represents *an element, a compound, or a mixture*

What state of matter?
Element, compound, mixture?





Elements

1. Each element has a unique name, symbol, and number
2. Capitalize first letter of element name: hydrogen _____, carbon _____
3. If there's a 2nd letter it is lower case: helium ____, calcium ____, cobalt ____

Careful! CO is carbon monoxide not cobalt

Most symbols are from English names:

hydrogen ___; oxygen ___; Helium ___

Some are from Latin names:

lead ___ (plumbum)
gold ___ (aurum means "golden dawn")

nonmetals, semimetals, and metals

1. Nonmetals (except H) are located on the right side
2. Semimetals are along the stair-step line (except Aluminum which is metal)
3. Metals are on the left side of the stair-step line

Properties of Metals vs. Nonmetals

Metals	Nonmetals
shiny appearance	dull appearance
malleable, ductile All solids but Hg	Brittle solids Many gases
density – usually high melting point - high	density – usually low melting point low
Good conductors of heat & electricity	Poor conductors (make better insulators)

Semimetals (metalloids)
Have properties in between

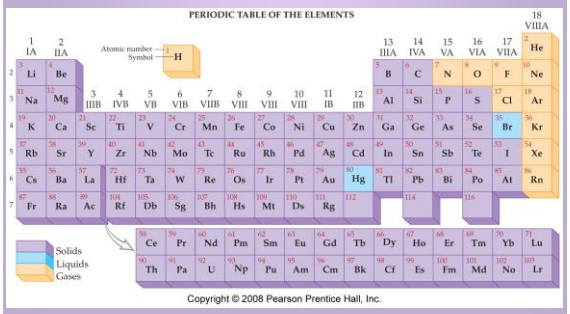
Physical States of the Elements at 25 ˚C and normal atmospheric pressure
KNOW THESE

❖Only _____ are liquids

❖H_2, N_2, O_2, F_2, Cl_2, and all Noble gases (Group VIIIA) are gases

❖All other elements are _____

Physical States of the elements



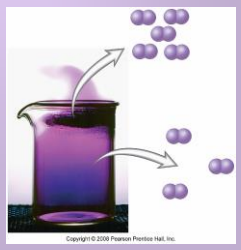
7 Diatomic elements

Diatomic means two atoms bonded together

Have no fear of ice cold Beer!

$H_2(g)$ $N_2(g)$ $F_2(g)$ $O_2(g)$ $I_2(s)$ $Cl_2(g)$ $Br_2(l)$

Two Diatomic Elements
Bromine $Br_2(l)$ and Iodine $I_2(s)$



I should be able to point at any element and you tell me

1. Solid, liquid, or gas
2. Diatomic or not
3. Metal, semimetal, nonmetal

Let's play! I'll point at several elements…

Physical properties describe appearance color, odor, taste, texture, melting point, physical state (s, l, or g),

Chemical properties - describe how a substance reacts or behaves

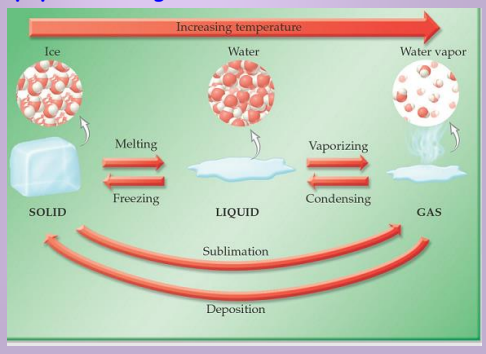
hydrogen reacts explosively with oxygen, iron rusts slowly in air, toxic, inert, corrosive, combustible, non reactive

Physical change: the molecules stay the same with the SAME formula.

Physical Changes ARE changes in state (s ⇆ l ⇆ g)

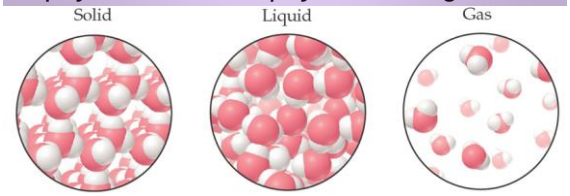
Ex: _____

physical changes – learn these 6 terms



http://www.visionlearning.com/library/module_viewer.php?mid=120

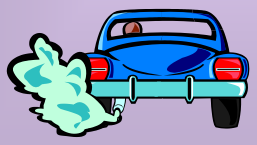
Note that the H_2O molecules remain H_2O regardless of whether the sample is a solid, liquid, or gas; changes in physical state are *physical* changes



Chemical Changes: the molecules break apart and rearrange. The chemical formula CHANGES.

(aka chemical reactions)

Starting substance is destroyed and a new substance is formed.



Ex: burning gas

Physical or Chemical?

$CH_4(g) \rightarrow CH_4(l)$

$CH_4(g) \rightarrow C(s) + 2\ H_2g)$

$H_2O_2(l) \rightarrow H_2O_2(g)$

$H_2O_2(l) \rightarrow H_2(g) + O_2(g)$

CHEMICAL REACTIONS

REACTANTS → PRODUCTS

Starting substances =reactants;
Substances formed =products.

Ex: $2\ H_2 + O_2 \rightarrow 2\ H_2O$

Ex: Chemical reaction between sodium metal $Na_{(s)}$ and chlorine gas $Cl_{2(g)}$. They produce salt, NaCl, which is a totally different chemical with different formula and properties than the reactants.