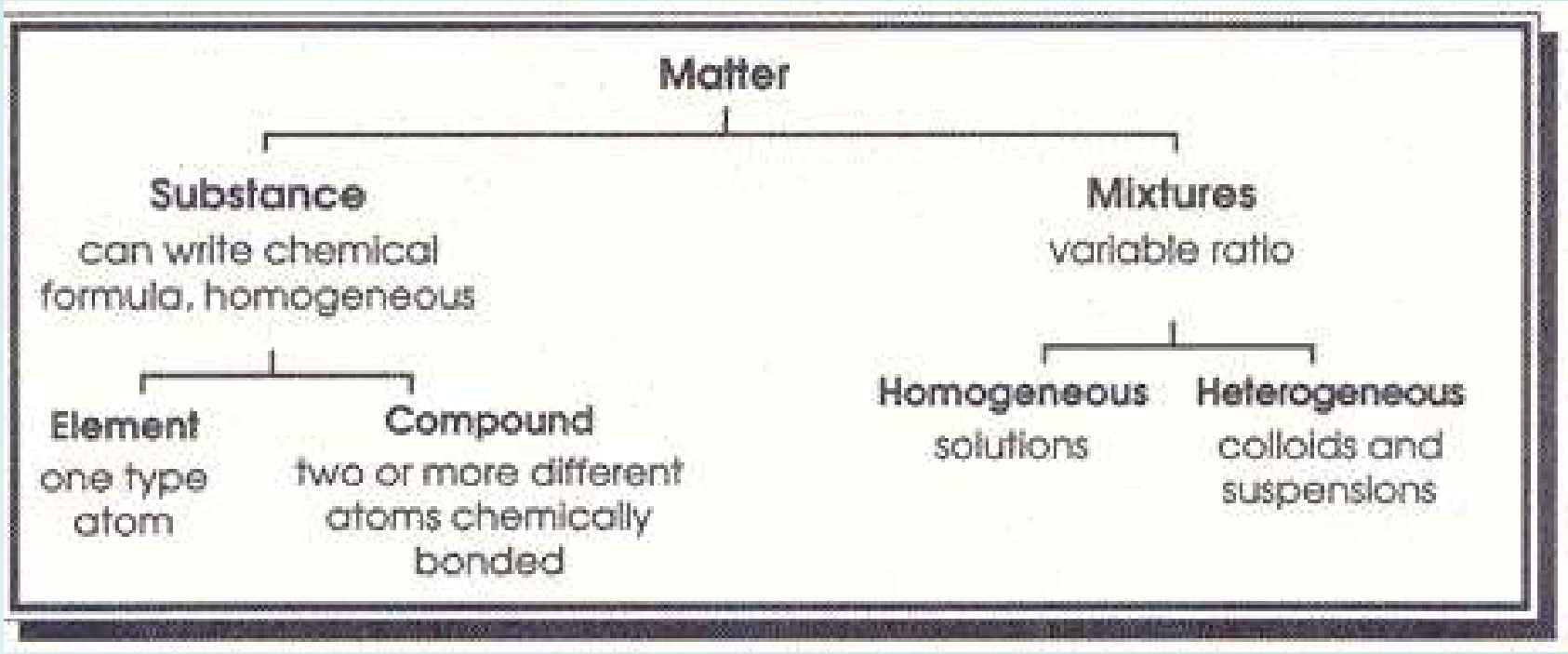
Bell Ringer

1. Define matter.
2. Give an example of matter.
3. What are the states of matter?

Properties of Matter



Matter - Anything that has mass and occupies space

Types of Matter

- **Pure Substances** – Those substances made up of one kind of matter.
  - **Elements:** Contain only one type of atom, H, He, Na, Mg, C, N, O
  - **Compounds:** chemical combination of two or more elements - CO_2, H_2O, $C_6H_{12}O_6$, NaCl
- **Mixed Substances** (**Mixtures)–** two or more substances that are mixed together physically but not chemically combined.
  - **Homogeneous** Mixture: a very well mixed mixture - solution of sugar water
  - **Heterogeneous** Mixture: not evenly mixed - handful of dirt, Rocky Road Ice Cream,

Mythbusters – Walking on Water

Two types of Mixtures

Homogeneous

given sample is uniform throughout

evenly mixed

Heterogeneous

NOT uniform

Solution animation

Solutions are a type of homogeneous mixture as are alloys (mixtures of solids)

What's the difference between a homogeneous mixture and a compound?

- Components of a compound are CHEMICALLY bound together.

Components of a mixture are physically blended.

- Compound composition is ALWAYS the same. Every sample, every time, everywhere.

With homogeneous mixtures, multiple samples can contain different relative amounts of the same components.

$CuCl_2$ powder and solns

Types of Mixtures

Solution
Kool aid

A mixture that forms when one substance dissolves completely in another and forms a homogeneous mixture

Particles are very small

Suspension
Italian salad dressing

A heterogeneous mixture that separates into layers over time

Particles are too large to remain dissolved.

Colloid - milk

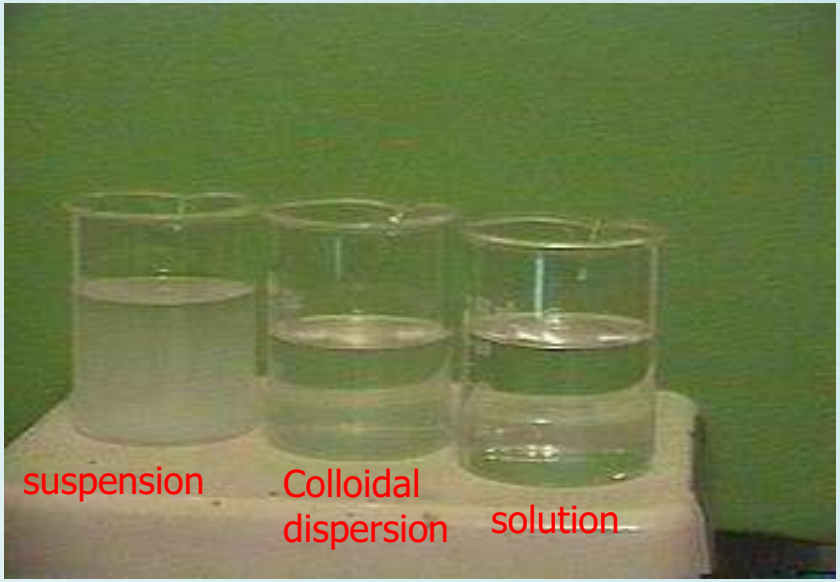
A mixture that contains particles that are intermediate in size between the small particles in a solution and the larger particles in a suspension, *light is scattered through it*

Solutions and Suspensions

Suspension - the particles are temporarily suspended in the liquid & are large enough to collectively make the material appear cloudy. They will settle out after a while.

Colloidal dispersion - very small particles spread throughout the liquid which are large enough to reflect light, but not large enough to be seen individually. It may look either clear or cloudy in ordinary room light. The particles in a colloidal dispersion remain dispersed in the liquid and will not settle out.

A **solution**, on the other hand, will appear clear even when a light is shown through it. The particles are completely dissolved & never settle out.

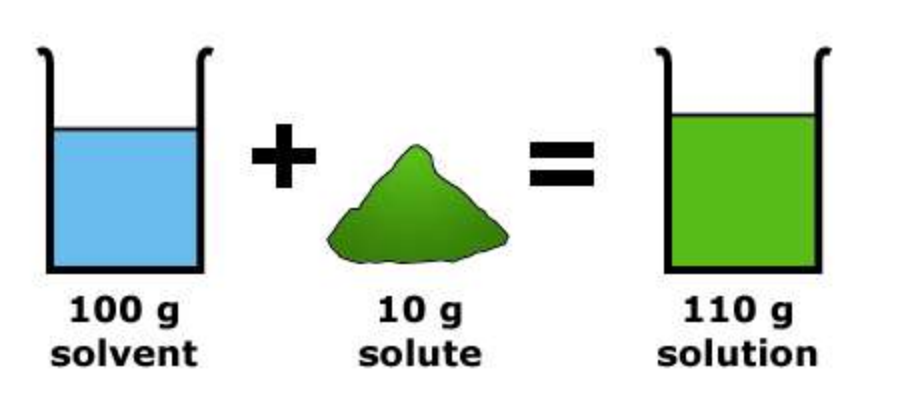


A mixture of flour & water

Colloidal dispersion spreads the light out

Solvents and Solutes

- Solvent – the part of the solution that is present in the largest amount
- Solute – the part of the solution present in the least amount



Parts of a Solution

What type of matter is . . . ?

Sand

heterogenous mixture

Sand and water

suspension

Cobalt

element

Cobalt chloride

compound

$NaC_2H_3O_2$ solution

homogenous mixture

Homogenized milk

colloid

Gold

element

Brass

Alloy of copper and zinc

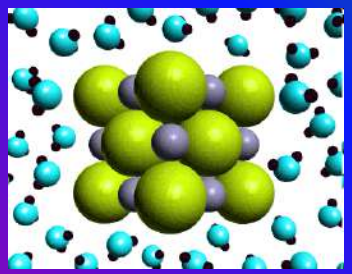
Warm-up

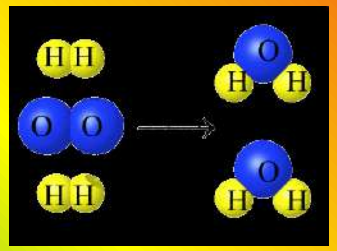
1. Explain the difference between Homogeneous mixtures and Heterogeneous mixtures.
2. Give an example of each type.

- Types of Matter Smartboard (we will do this part together)

Changes in Matter

- **Physical Change -**A change that alters the form of a substance but not the chemical makeup of the substance, a change of state
  - Words like: *crush, smash, tear, evaporate, slice, breakdown, dissolve, absorb, swell, burst*
- **Chemical Change** - One or more substances combine or decompose to form a chemically different substance
  - Words like: *react, burns, forms, decomposed, rusting, sours, rotting, digesting, cooked, molecular change*





Matter & Its Changes

- Chemical change- changes the material into a new substance i.e. hydrogen and oxygen combine to form water.
  - Chemical reactions take place when chemical bonds are either formed or broken.
  - Strong chemical bonds resist change: glass
  - Weak chemical bonds breakdown easily: wood
- A chemical change is like scrambling letters to form new words

made + steps → stampedes

Chemical Property

Observed only when a substance undergoes a chemical change…..

- Flammability: ability to burn in presence of Oxygen
- Reactivity: how readily a substance chemically combines with another substance
- ability of iron to rust

Clues for identifying Chem Rxns/Changes

1. Energy is absorbed or given off as heat* or light
2. Change in color*
3. Production of a gas* (see “smoke”, see bubbles in a soln, smell odor)
4. Formation of a precipitate (solid)
5. Irreversibility

* Can also just be a physical change

Chemical change

- Change in color: match, silver, copper
- Production of Gas: mentos and coke
- Formation of a Precipitate: milk curdling, cottage cheese

- Remember: Physical change the composition stay the same, Chemical change the composition changes

Physical Changes

- Viscosity: resistance to flowing, depends on temp
  - Which has a higher viscosity: water or syrup?
  - Syrup!!!
- Conductivity: ability to allow heat to flow
- Malleability: ability of a solid to be hammered without shattering
- Hardness: scratch an object to see which is harder, diamond hardest, talc softest
- Melting and Boiling points: temp at phase changes
- Density: m/v test purity of a substance

Matter & Its Changes

- Physical Changes – **Alters form or appearance but doesn't change it into another** substance ie. Water evaporates into water vapor, a rock is broken into pieces
- It's like printing a word in a different font, it's the same word just looks different!

stampedes → stampedes

Using these properties

- We can use these properties to identify materials
- Ex solve crime
- Use to choose materials for building or creating something
- Using wax, clay, metal for sculptures
- Filtration: separates based on size of particles
- Distillation: separates the substances in a solution based on melting points

Chemical vs. Physical Change

"When matter undergoes a chemical change, the composition of the matter changes. When matter undergoes a physical change, the composition of the matter remains the same."

Bell Ringer

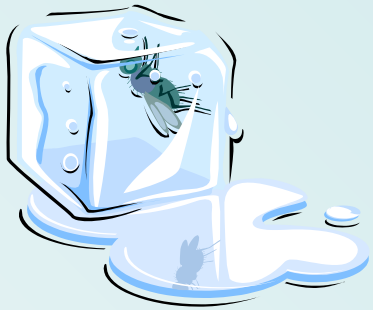
Indicate whether the following are chemical or physical changes:

1. mixing salt and pepper
2. freezing water
3. cutting a marshmallow
4. toasting a marshmallow
5. burning wood
6. adding chocolate syrup to milk
7. iron rusting
8. melting sugar
9. melting wax
10. burning wax
11. hammering gold into a thin foil
12. pouring molten gold into a mold
13. dissolving sugar in water boiling water
14. magnetizing a piece of steel
15. breaking glass

Smart Board Review on Chemical vs. Physical Properties and Changes

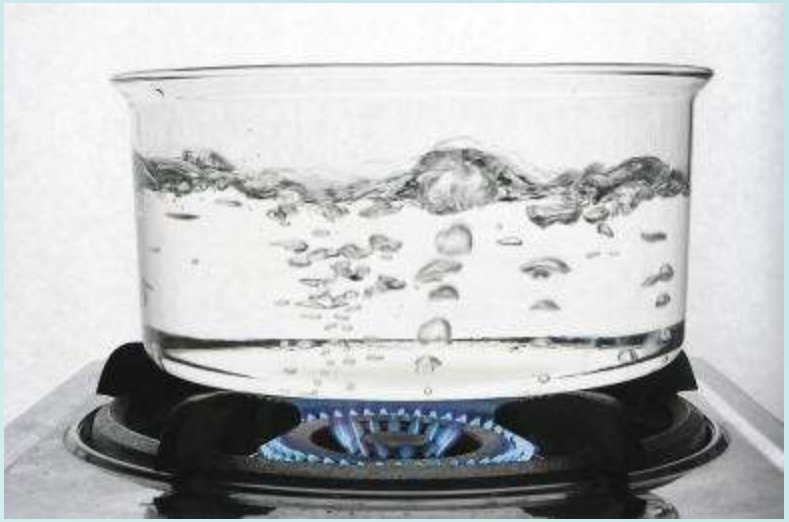
Melting Point vs. Boiling Point

- Melting point - The temperature at which a substance changes from a solid to liquid.



extremeearth.net

- Boiling Point – The temperature at which a substance boils.

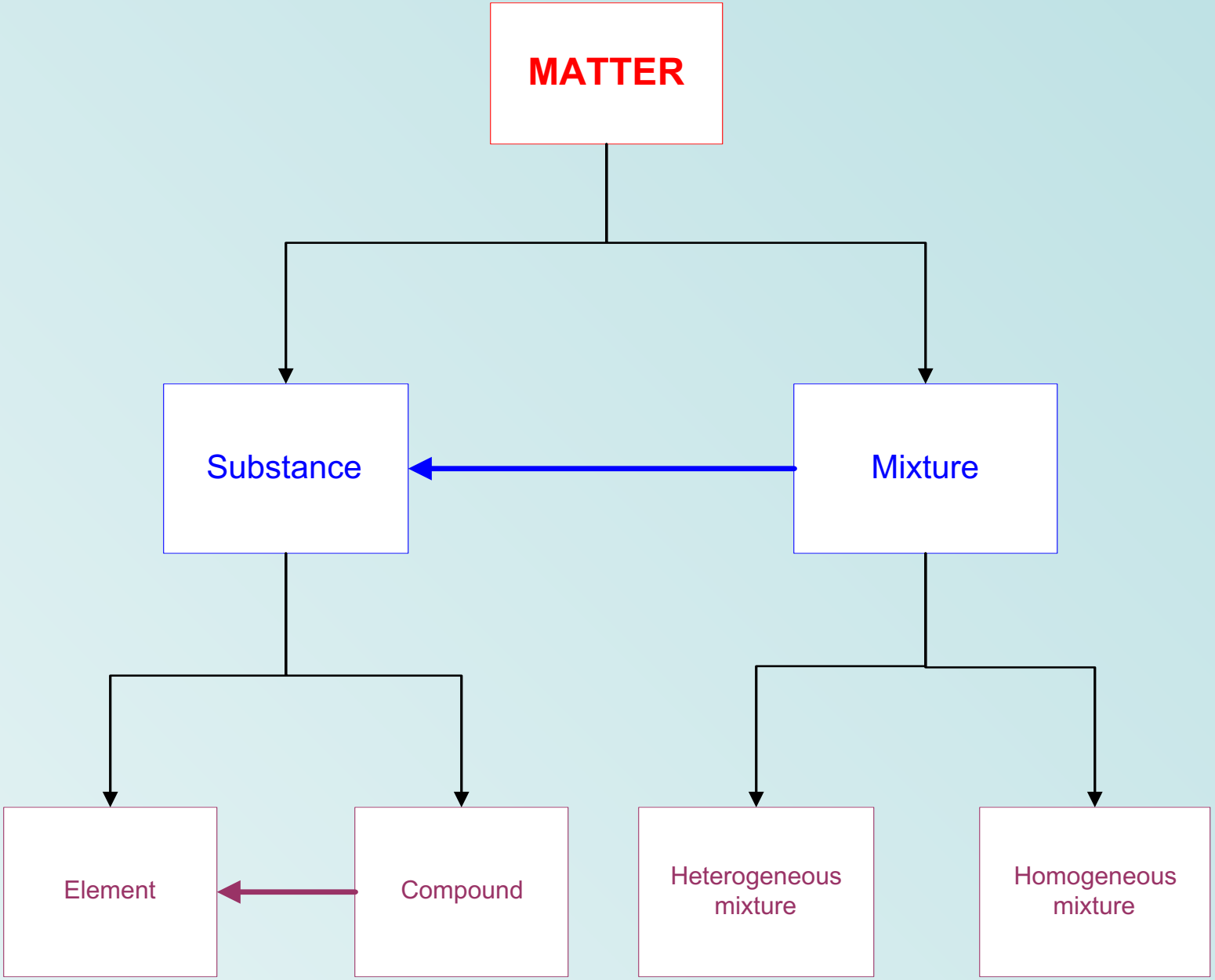


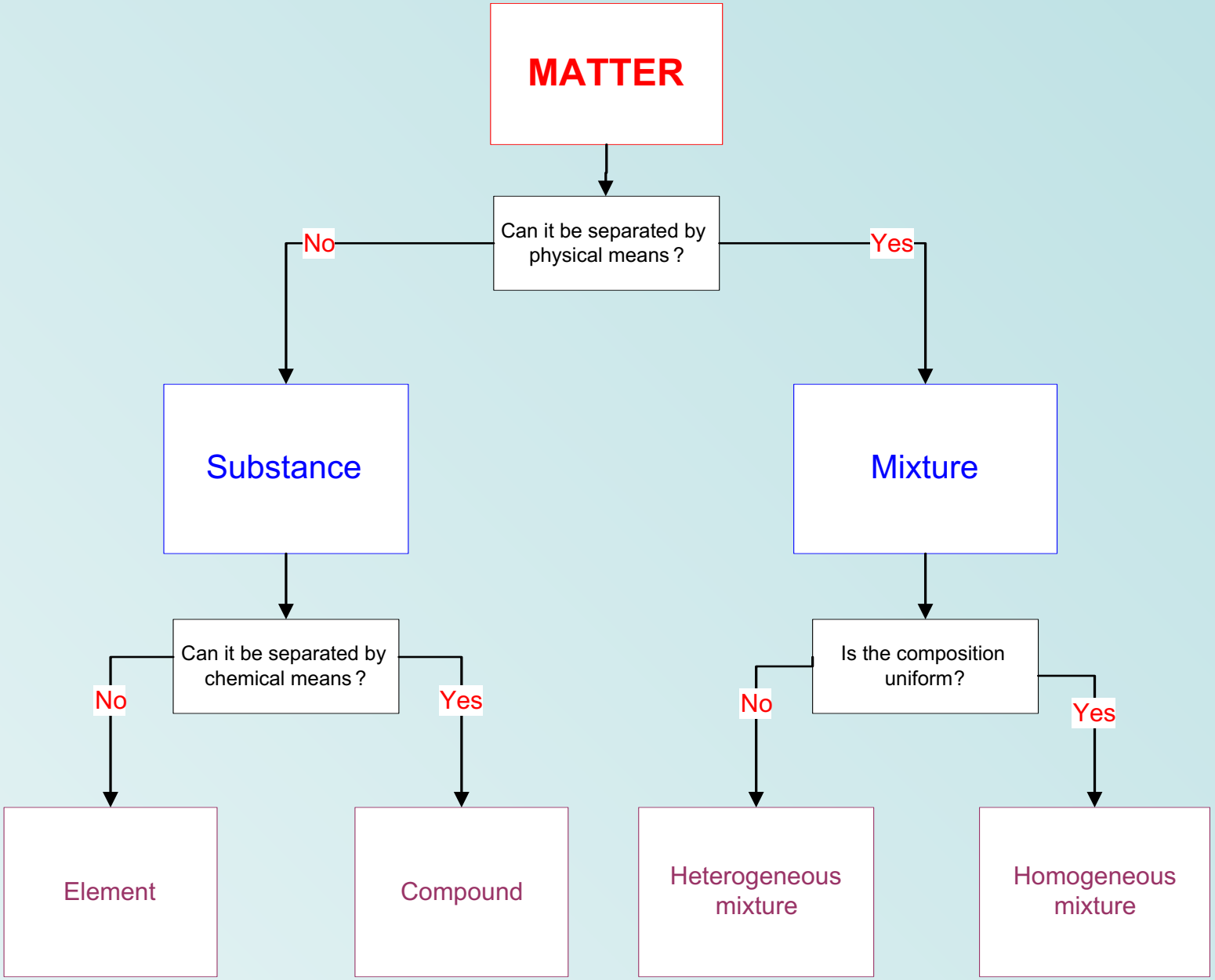
Melting point and Boiling points of Some Substances

- Which of these substances are liquids at room temperature?

Melting and Boiling Points of Some Substances		
Substance	**Melting Point**	**Boiling Point**
Hydrogen	−259.3°C	−252.9°C
Nitrogen	−210.0°C	−195.8°C
Ammonia	−77.7°C	−33.3°C
Octane (found in gasoline)	−56.8°C	125.6°C
Water	0.0°C	100.0°C
Acetic acid (found in vinegar)	16.6°C	117.9°C
Table salt	800.7°C	1465°C
Gold	1064.2°C	2856°C

- Answer: octane, water, and acetic acid


MATTER
Substance
Mixture
Element
Compound
Heterogeneous mixture
Homogeneous mixture


MATTER
Can it be separated by physical means ?
No
Yes
Substance
Mixture
Can it be separated by chemical means ?
No
Yes
Is the composition uniform?
No
Yes
Element
Compound
Heterogeneous mixture
Homogeneous mixture

Review on Properties of Matter!

Physical Property	Definition
Viscosity	a. ?
Malleability	b. ?
Melting point	c. ?

a. The tendency of a liquid to resist flowing
b. The ability of a solid to be hammered without shattering
c. The temperature at which a substance changes from a solid to liquid.

Review on Properties of Matter!

Clue	Example
Change in color	a. ?
Production of gas	b. ?
Formation of precipitate	c. ?

a. Copper roof changing color from red to green when exposed to moist air

b. Formation of carbon dioxide gas when vinegar is added to baking soda

c. Formation of cottage cheese curds when acid is added to milk

Main Menu

Complete Melting and Boiling Points activity

- You will need a red, blue, and yellow colored pencil and a regular pencil to complete this activity.
- You really don't have to go to SAS, but if you want to, here's the info:
- Sasinschools.com
- Quick launch #977

Bell Ringer

- Determine what state of the matter is for each of the following:

Substance	Melting Point
Antimony	630.79
Argon	-189.3
Arsenic	817
Neodymium	1016
Neon	-248.5
Neptunium	640

CSI Lab

Bring yo textbook tomorrow!!!

Bell Ringer

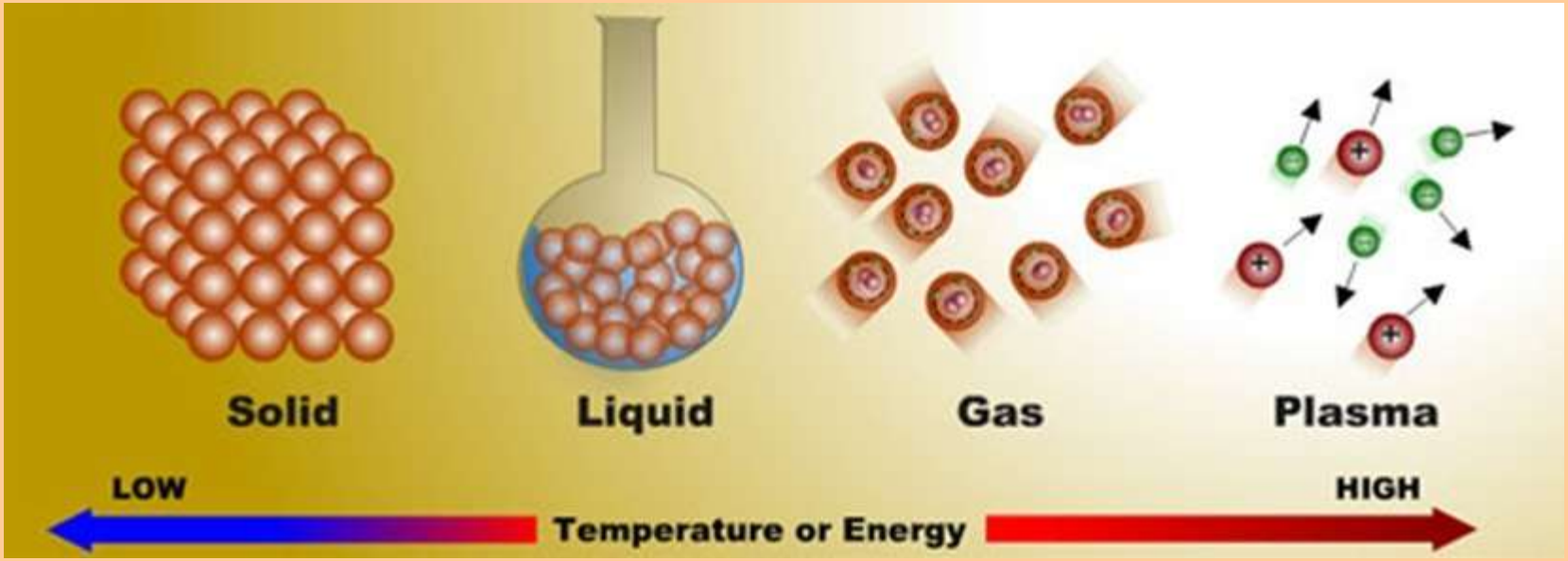
- Mercury at room temperature is in what state of matter?

- If water is cooled from 120ºC to 22ºC how many state changes has it gone through?

States of Matter

States of Matter

1. Solid
2. Liquid
3. Gas
4. Plasma



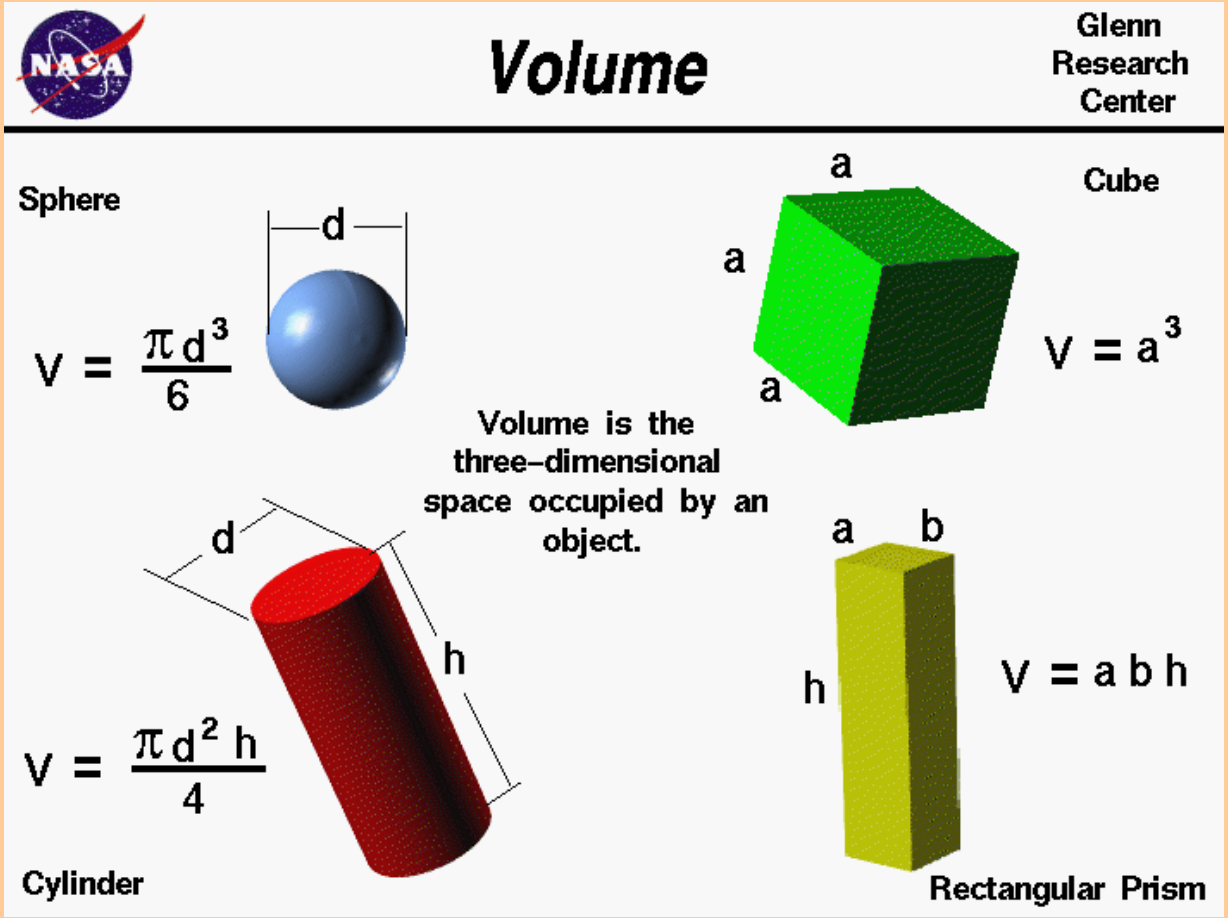
Phase Changes

- Turn to page 84 in your textbook.
- Read section 3.3 pages 84-91
- Answer the all the questions on p. 91 Section Assessment

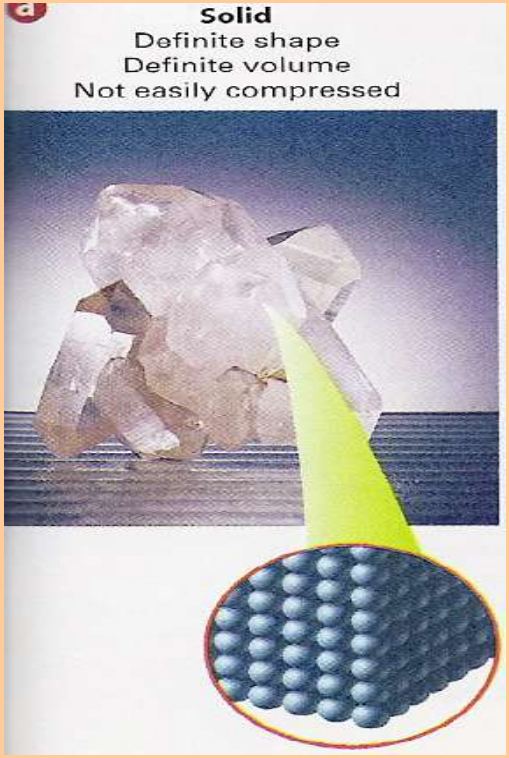
	Solid	Liquid	Gas
Packing/spacing of particles			
Movement of particles			
Can it flow?			
Take shape of container?			
Fill volume of container?			
Compressible?			

What is volume?

- the amount of 3-dimensional space occupied by an object



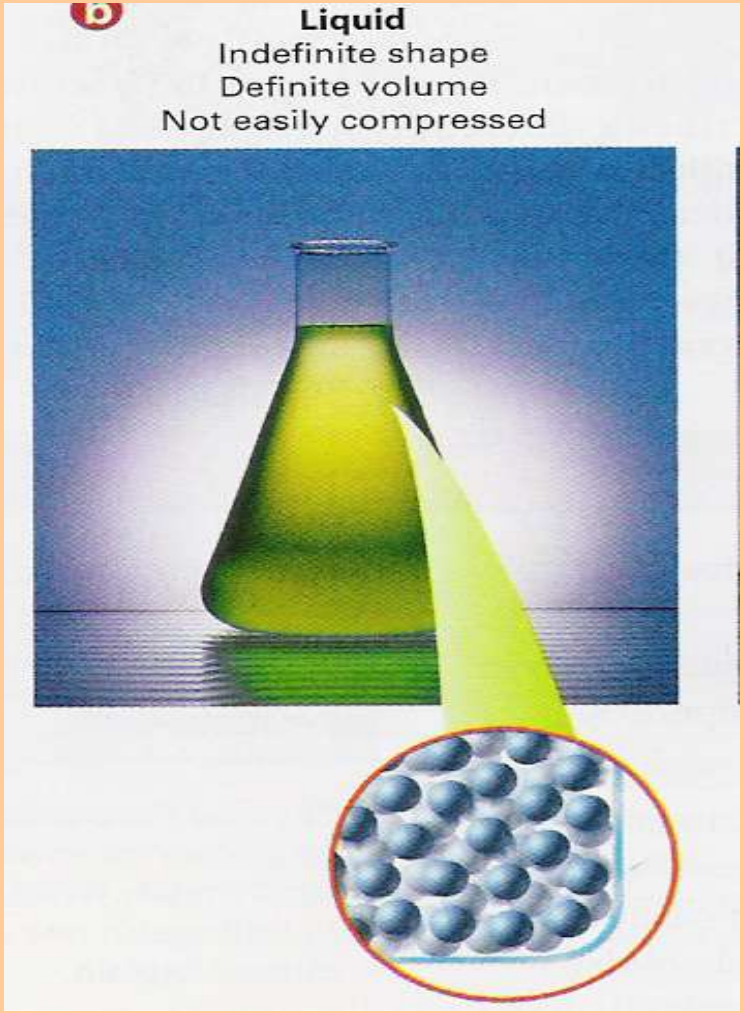
Characteristics of Solids



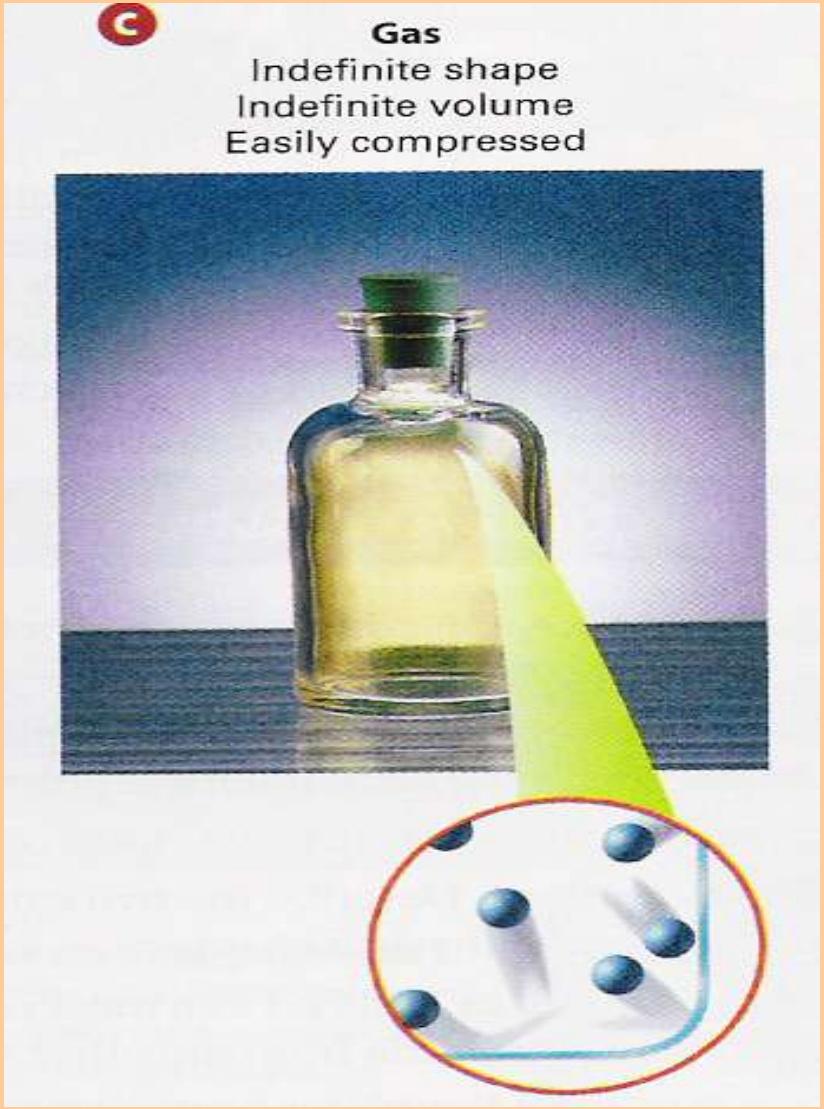
- Definite shape
- Definite volume
- Particles packed
- Expands slightly when heated

Characteristics of Liquids

- volume
- Takes shape of its container
- Particles
- Expands when heated



Characteristics of Gases



- shape
- volume
- Particles
- Is easily compressed

Hot Air Balloons

http://videos.howstuffworks.com/discovery/36118-massive-engines-how-hot-air-balloons-work-video.htm

	Solid	Liquid	Gas
Packing/spacing of particles			
Movement of particles			
Can it flow?			
Take shape of container?			
Fill volume of container?			
Compressible?			

Gas or Vapor??

Gas exists in the gaseous state at room temperature.

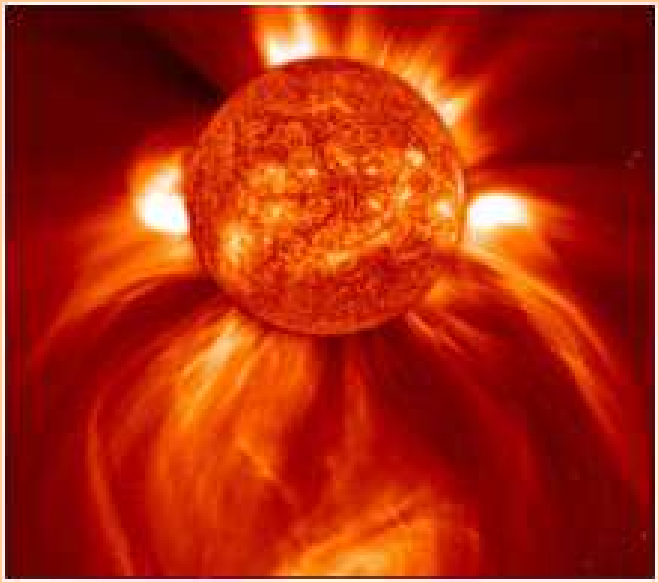
Oxygen, Hydrogen, Nitrogen, Carbon dioxide

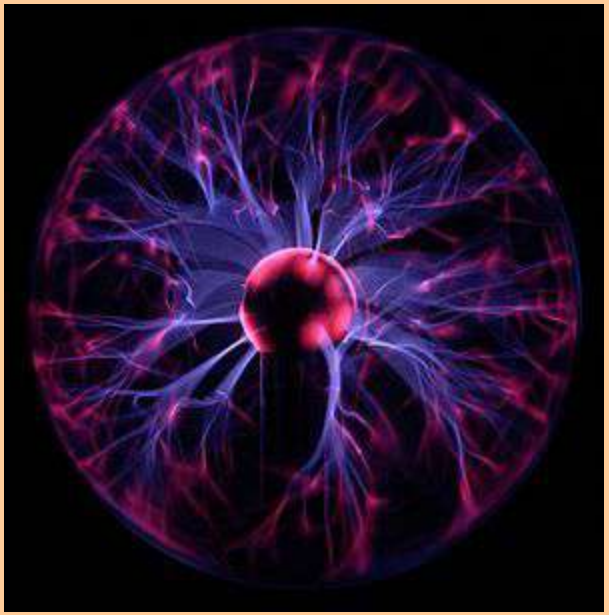
Vapor the gaseous state of a substance that generally exists as a liquid or solid at room temperature.

Water vapor, Acetone, Nail polish remover, Perfume

Plasma

- exists only at extremely high temperature
- an ionized gas
- electrons have been stripped away from atoms
- Plasma ball demonstration





Bell ringer

1. What are the characteristics of a solid?
2. What is plasma?
3. Give an example of freezing.
4. Give an example of condensation.

What's the Matter Mini Lab

All matter that we see or touch, and even ones that we can't see or touch are in one of three states: They are solids, liquids, or gases. In this activity you will be studying the different states of matter. When scientists think or talk about matter they mean every substance in the universe from the largest planet to the tiniest speck of dust. But what is matter? In the following experiment you will observe a form of liquid matter to try to determine what matter is made of.

Materials

- 10mL graduated cylinder
- 50mL graduated cylinder
- Pipet
- water
- alcohol

Procedure

1. Put 20.0 mL of water in a 50 mL graduated cylinder. Be careful! Your measurements need to be as precise as possible!!!! Use an eyedropper or pipet if needed!
2. Put 10.0 mL of alcohol into the 10 mL graduated cylinder.
3. Carefully pour the alcohol into the water.
4. Observe what happened in the graduated cylinder and answer the questions below.

Questions:

1. What happens when you mix the two liquids together?
2. After the liquids were mixed together, do they take up the same space as they did before? How do you know?

What’s the Matter mini-lab explained

- Sometimes the volume of the mixture is less than, some times the sum of, and other times greater than the volume of the components. In the case of ethanol (alcohol) and water the volume of some concentrations is less than the sum of the components. Liquid water has a somewhat "open" structure that is broken up by the addition of ethanol so the mixture "collapses". In general there is no good way of predicting volumes of mixing of either liquids or of liquids and solids.

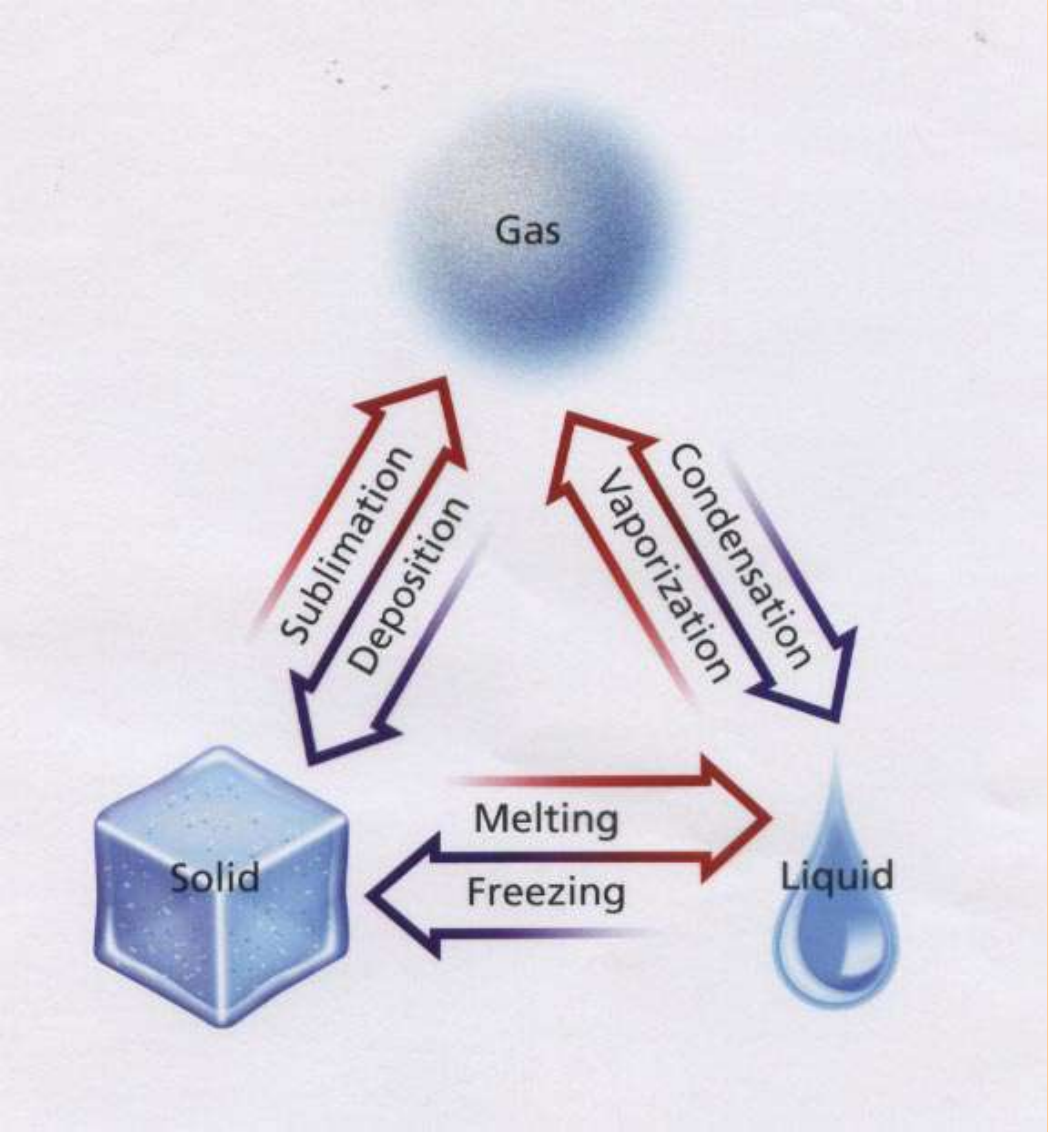
Kinetic Molecular Theory

- All particles of matter are in constant motion:
  - Particles of a solid vibrate in a fixed location
  - Particles of liquid
  - Particles of a gas

Phase Changes – see p.85 in text!

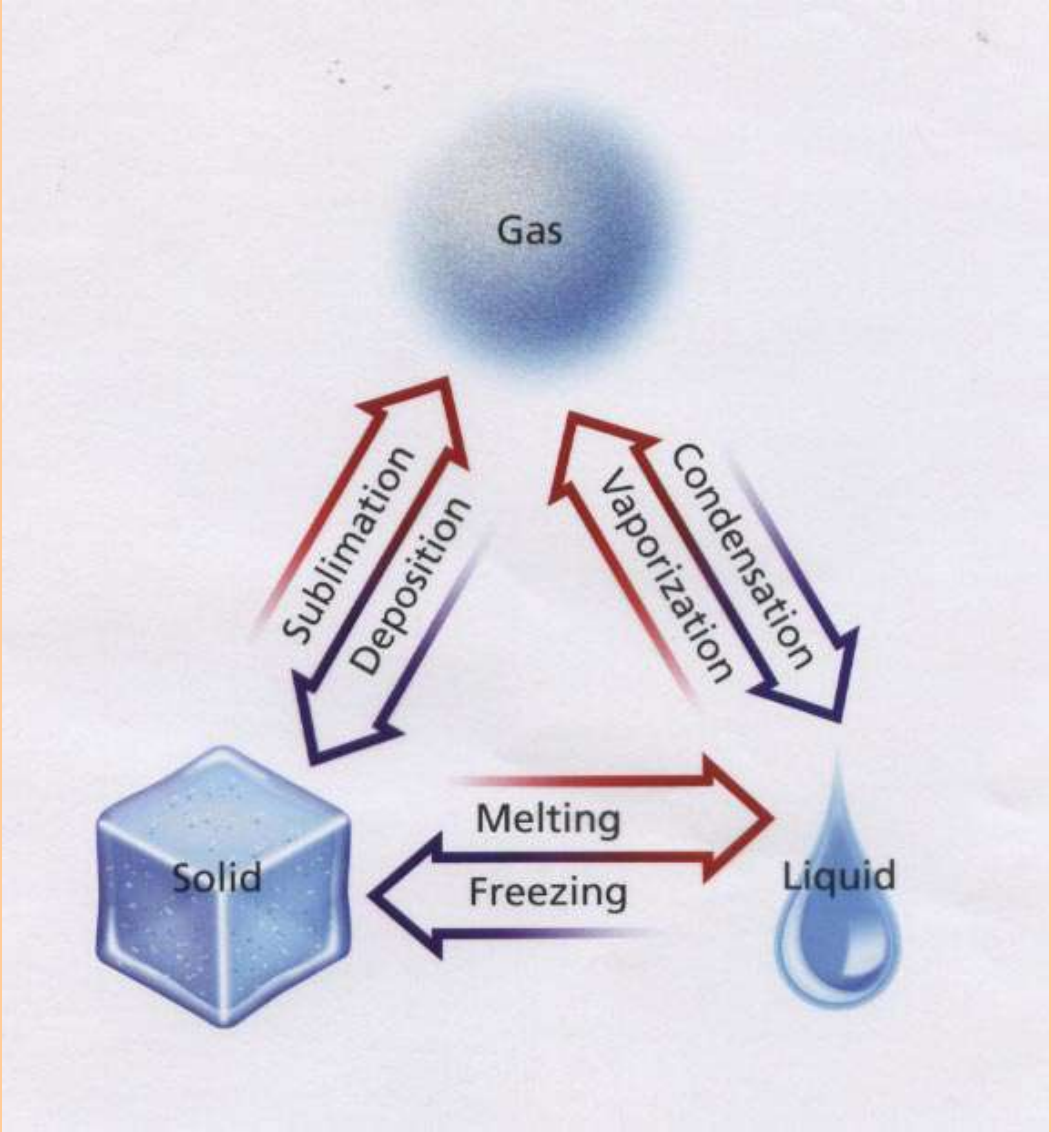
- a.k.a. changes of state

- melting/freezing
- vaporization/ condensation
- sublimation/ deposition



Phase Changes – see p.85 in text!

- TEMPERATURE does not change during a phase change.
- ENERGY is being absorbed or released during a phase change.
- Red arrows are endothermic!
- Blue arrows are exothermic!



Energy Changes

- A process that releases energy is called an exothermic process.

- A process that absorbs energy is called an endothermic process.

Melting

- solid → liquid

- particles become more disordered
- particles ABSORB energy to increase their disorder
- endothermic

Freezing

- liquid → solid

- particles become more orderly
- particles RELEASE energy to become more ordered
- exothermic

Vaporization

- liquid → gas

- particles become more disordered
- particles ABSORB energy to increase their disorder
- boiling, evaporation
- endothermic

Condensation

- gas → liquid

- particles become more orderly
- particles RELEASE energy to become more ordered
- exothermic

Sublimation

- solid → gas
- NO change to liquid in between!
- particles become more disordered
- particles ABSORB energy to increase their disorder
- dry ice (solid CO_2), iodine
- endothermic

Deposition

- gas → solid
- particles become more orderly
- particles RELEASE energy to become more ordered
- frost on a window
- exothermic

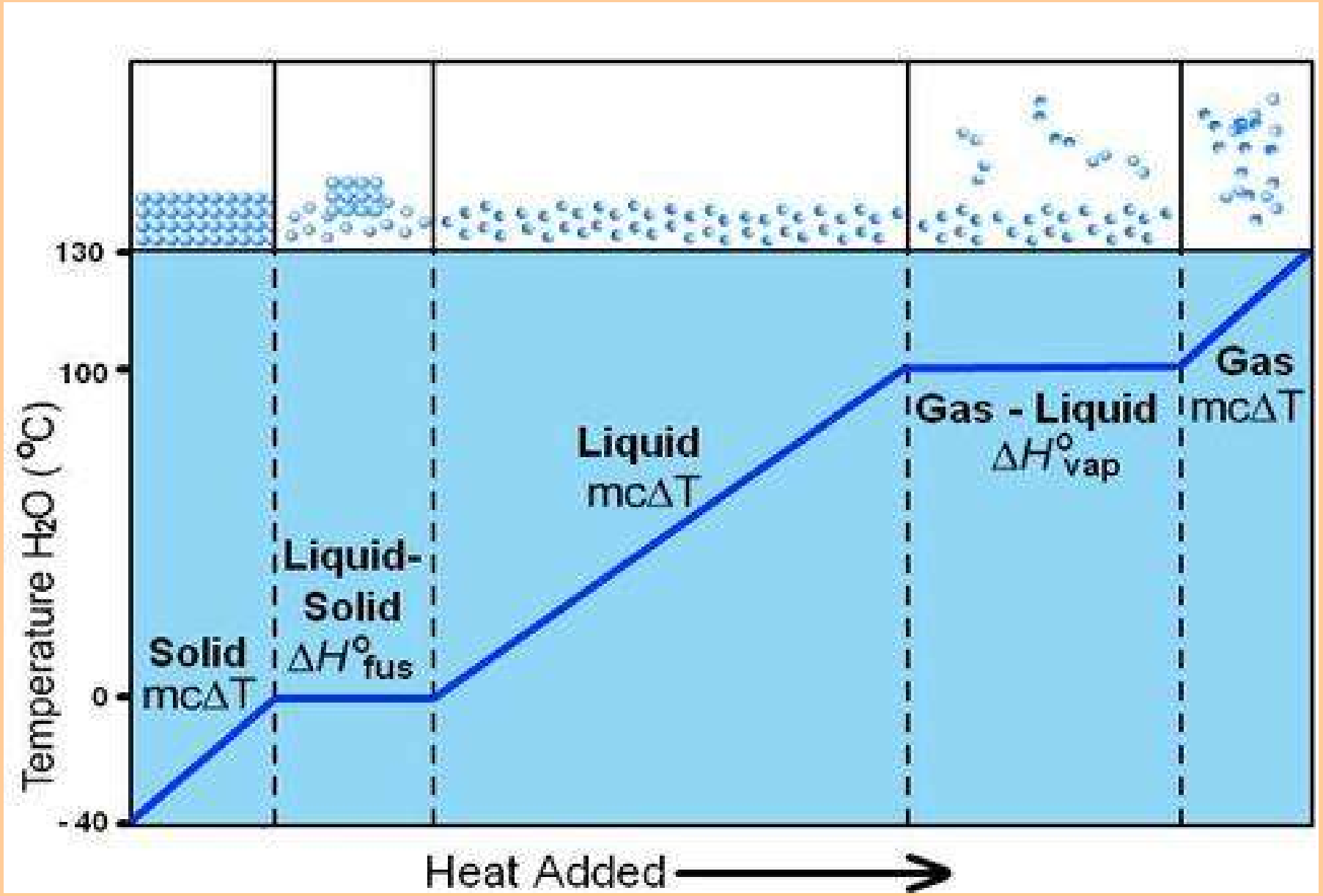
Heating Curve

- Graph showing effect on temperature as heat is added to a substance

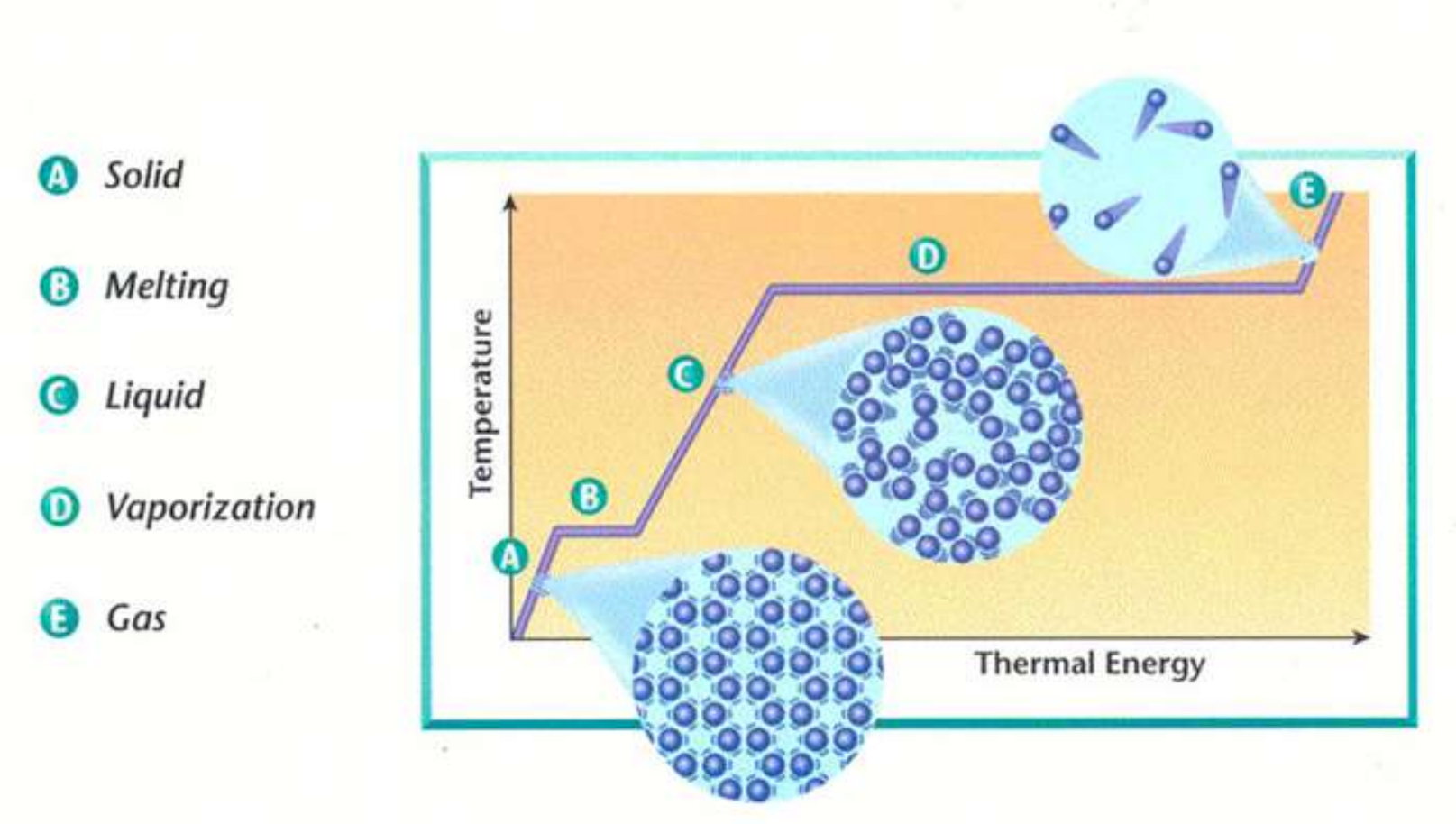
- Shows the physical changes that occur as heat is added (changes in temperature AND changes of state)

Heating Curves

- Temperature does not change during a phase change.
- Energy is being absorbed or released during a phase change.
- Exothermic – energy (heat) is released
- Endothermic – energy is absorbed


130
100
0
-40
Temperature H_2O (°C)
Solid
mcΔT
Liquid-
Solid
ΔH°_{fus}
Liquid
mcΔT
Gas - Liquid
ΔH°_{vap}
Gas
mcΔT
Heat Added

Heating Curve Graph



Heating Curve Graph Activity

- Please do the Heating Curve Graph Activity

Physical or Chemical Change Lab

Bell ringer

- Explain the differences between:
  1. melting/freezing
  2. vaporization/ condensation
  3. sublimation/ deposition

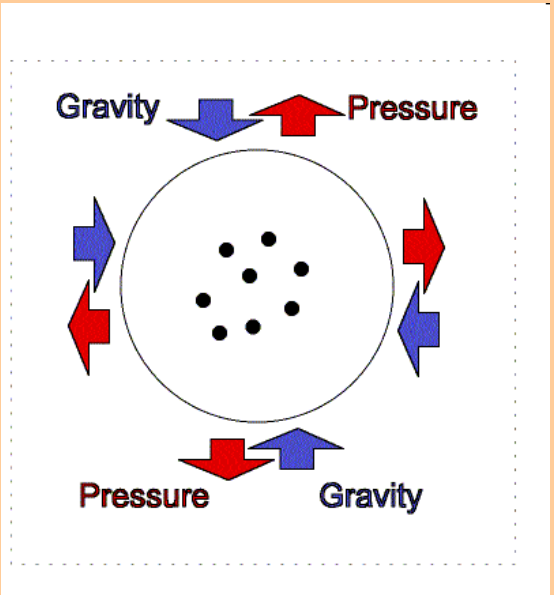
Kinetic Theory of Gases

- Gas particles are in constant, random motion.
- Particles do not interact except when they collide by chance.
- No forces of attraction exist between particles.

Gas Pressure

- a result of the collisions between gas particles and the walls of the container

- measured in pascals (usually kilopascals, kPa)



The Combined Gas Law

On one side of a notecard make it look like this →

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Practice Problems

- At a given temperature, gas with a pressure of 150 kPa has a volume of 0.8L. If the pressure decreases to 75kPa and the temperature remains the same, what will be the volume of the gas?
- A liter of gas has a pressure of 300kPa. If the gas is put into a 2L container, what will be its pressure, assuming its temperature does not change?

- A given volume of gas at a temperature of 100K has a pressure of 225kPa. At a higher temperature, the same volume of gas has a pressure of 450kPa. At what temperature does the gas have this higher pressure?
- Gas under 200kPa of pressure at a temperature of -150C fills a 0.5L container. If the temperature decrease to -225C, but the pressure stays the same, what will be the volume of the gas?
- A volume of 1.5L of a gas at a temperature of 150K has a pressure of 240kPa. If the temperature of the gas increase to 200K and the volume decreases to 1.0L what is the new pressure of the gas?

Al Can Lab

- Observing the effect of Temperature on Air Pressure.
- Materials needed:
  - aluminum cans
  - Hot plates
  - Beakers
  - Beaker tongs
  - Trays with water

- Answer the 4 analysis questions on your paper!

Extra Practice

- At the temperature of 274K the gas in a cylinder has a volume of 4L. If the volume of the gas is decreased to 1L what must the temperature be for the gas pressure to remain constant?

- At 284K, the gas in a cylinder has a volume of .5L. The gas expands to .6L. What will the final temp be for the pressure to remain constant?