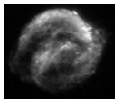
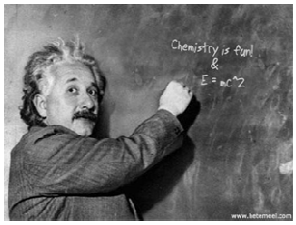


Matter & Energy



LPT

Matter, Changes & Energy

Chemistry studies matter and its interactions

Matter = has mass & occupies space

Space = measurable volume
Mass = has "intrinsic (just is) property" inertia
Mass = measure of quantity
Inertia =resistance to change in motion

Interactions with other substances requires Energy

Energy = ability to do work
Energy = ability to move matter
Energy = "change agent'

LPT

So, chemistry explores everything you perceive!

LPT

Energy

Kinetic	Potential
Depends On Motion	Depends On Position



Still water at top = Potential

Moving water thru generator = Kinetic

Work = mass moved through a distance

no movement = no work

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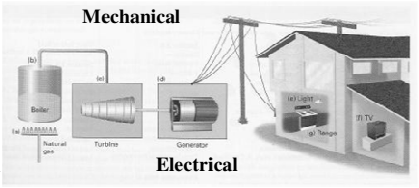
Energy

Conservation of Energy:
Energy is neither created or destroyed, but only transformed
(energy of universe is constant)

Heat



Chemical
Nuclear
Solar

Heat & Light

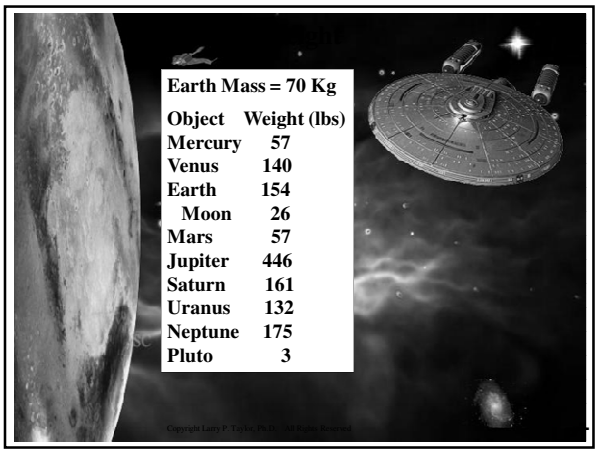
LPT

Mass vs Weight

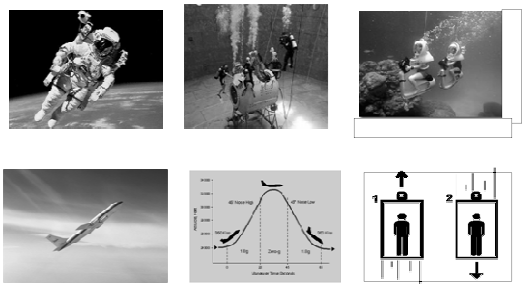
Mass	Weight
Amount of matter	Depends on force (gravity)
Independent of location	Changes with location
Can never be zero	Can be zero
Measured in kilograms	Measured in Newtons
Measured in slugs	Measured in pounds


On earth, mass and force of gravity are constant
So, these terms are often interchanged (incorrectly)

LPT



Mass vs. Weight



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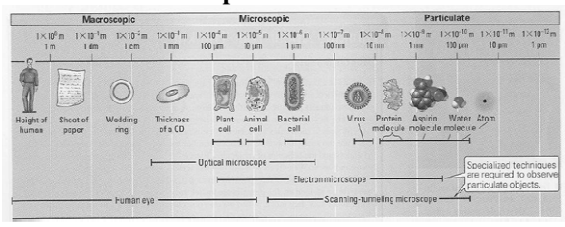
Descriptions of Matter



Macroscopic = Visible to eye
Microscopic = visible with microscope
Particulate = atoms & molecules … must be modeled

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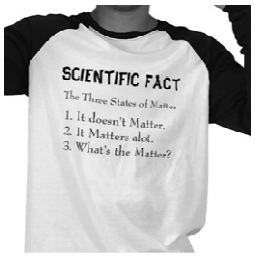
States of Matter: Solid, Liquid, Gas



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States of Matter - Solid

Form	**Rigid**
Compressibility	**Very Low (Exam→ Not Compressible)**
Shape	**Constant (definite)**
Volume	**Constant (definite)**
Particle Movement	**Vibration in fixed position**

Example: Ice

LPT

States of Matter - Liquid

Form	**Fluid (Flows)**
Compressibility	**Very Low (Exam→ Not compressible)**
Shape	**Variable (Fills Container)**
Volume	**Constant (Definite)**
Particle Movement	**Some attraction, particles move freely beneath surface**

Example: Water

LPT

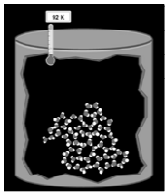
States of Matter – Gas (Vapor)

Form	**Fluid (Flows)**
Compressibility	**Very High**
Shape	**Variable (Fills Closed Container)**
Volume	**Variable (Fills Closed Container)**
Particle Movement	**Random, Independent**

Example: Steam

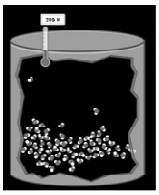
LPT

States of Matter: Solid, Liquid, Gas
Depends on Molecular Energy (Motion)



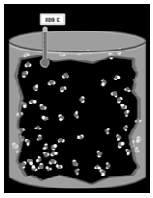
Solid

Little Movement



Liquid

More Movement



Gas

Most Movement

LPT

Changing States of Matter

Requires change in energy content at molecular level

Solid ⇒ Liquid ⇒ Gas

heat (energy) must be added

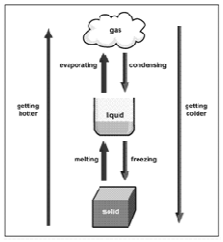
Gas ⇒ Liquid ⇒ Solid

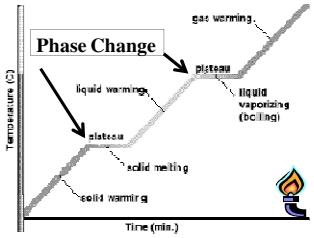
heat (energy) must be removed (lost)

During Phase Change:
Both states simultaneously exist
Temperature remains constant

LPT

Changing States of Matter





Warmer = More Energy
Colder = Less Energy

During Phase Change:
Both states simultaneously exist
Temperature remains constant

Melting: 334 J/g (~90 cal/g)
Boiling: 2260 J/g (~540 cal/g)

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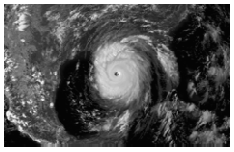
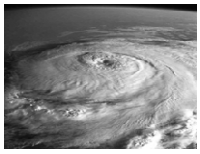
Heat Energy From Water Change of State: Energy for Storms





Ocean water is the warmest ever recorded:

It is inevitable that severe storms will:
increase in number
increase in severity

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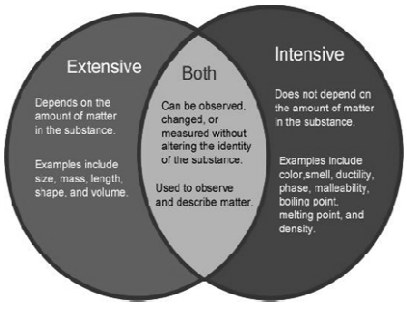
Physical Properties

Descriptions Observed or Measured

Size
Mass
Shape
Length
Volume
Color
Luster
Texture
Solubility
Odor
Hardness
Malleability
Ductility
Magnetism
State of Matter
Melting Point
Boiling Point
Density



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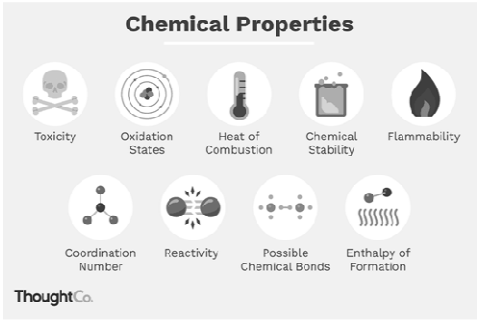
Chemical Properties

Descriptions Based on Interactions with Other Substances



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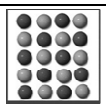
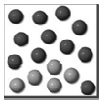
Mixtures

Two or more substances
Can involve all states of matter
Can have variable compositions
Properties depend on composition of components
Can be physically separated into components
Described as Homogeneous or Heterogeneous

Homogeneous	Heterogeneous
Uniform composition	Non-uniform composition
Uniform appearance	Non-uniform appearance
homo = "same"	Distinct parts, "phases"
	hetero = "different"





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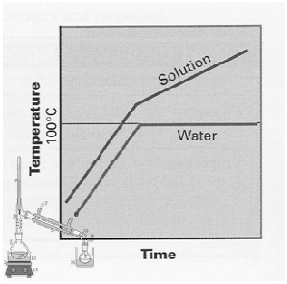
Mixtures – Boiling To Constant Temperature

Pure = Constant
Mixture = Variable

With mixture, composition changes as water boils away



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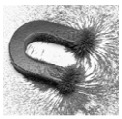
Separation of Mixtures

Solid From Liquid: Filtration

Liquid From Liquid: Distillation

Solid From Liquid: Evaporation



Solid From Solid: Magnetism
Solid From Solid: Sieving

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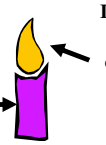
Changes
Changes = Alterations

Physical	Chemical
New form	Chemical identity changes
No new substance formed	New substance(s) formed
Examples:	Examples:
Wax melting	Wax burning
Sugar dissolving	Apple juice fermenting
	Iron rusting



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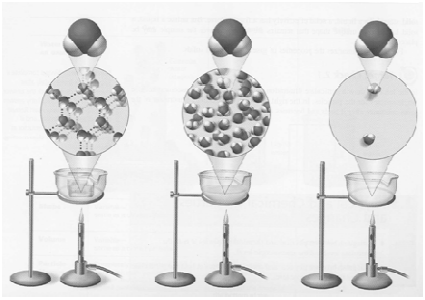
Physical Change

Chemical Entity (H_2O) Unchanged



Ice (Solid) Water (Liquid) Steam (Gas)

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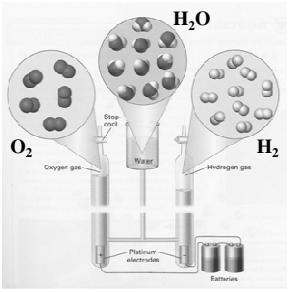
Chemical Change

Chemical Entity Changed



Water changed to hydrogen and oxygen

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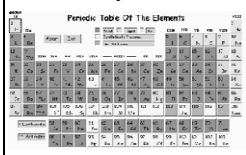
Classifying Matter

Single (Pure) Substance	Mixture
Single chemical	Two or more chemicals
Only one kind of matter	Variable compositions
Has one definite composition	Properties depend on composition
Has definite properties	Can be physically separated or decomposed into components
Homogeneous	Homogeneous or Heterogeneous
Chemically Pure Reagents	inks, beverages polluted water

LPT

Pure Substances

Elements	Compounds
Can't be sub-divided	Can be chemically sub-divided
Contains only 1 kind of atom	Contain 2 or more kinds of atoms (molecule)
	water, rust, salt, baking soda

Atom

Smallest particle of an element

Combines with other atoms to form molecules

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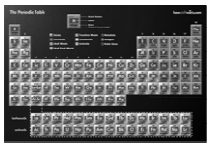
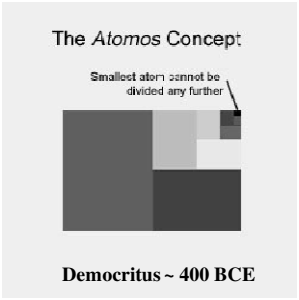
Atom

Cut an element into smaller & smaller pieces
Smallest remaining object of an element is atom





Democritus ~ 400 BCE

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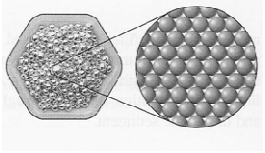
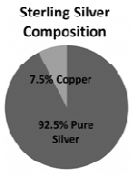
Silver = An Element



Sub-divisions Still Silver

Silver
Antimicrobial
"Silver Spoon"
Wagon Trains

Sterling Silver = A Mixture



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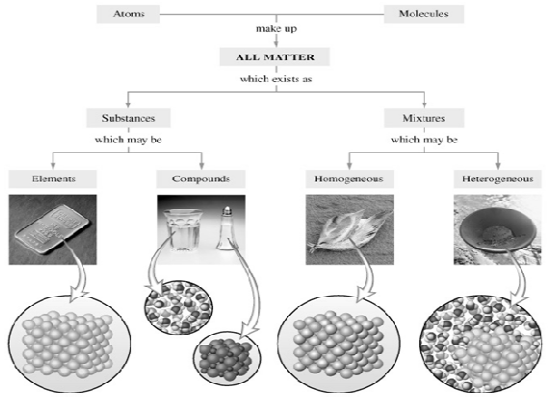

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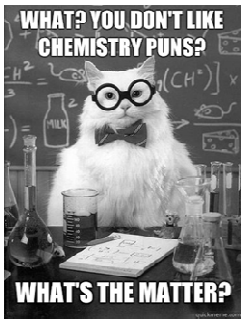
WHAT? YOU DON'T LIKE CHEMISTRY PUNS?
WHAT'S THE MATTER?


WE ALL MATTER

LPT