Matter and Change

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What is Matter?

- Matter is anything that takes up space and has mass.
- Mass is the amount of matter in an object.
- Mass is resistance to change in motion along a smooth and level surface.
- Examples

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Types of Matter

- Substance- a particular kind of matter - pure
- Mixture- more than one kind of matter

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Properties

- Words that describe matter (adjectives)
- Physical Properties- a property that can be observed and measured without changing the substance.
- Chemical Properties- a property that can only be observed by changing the type of substance.

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Properties

- Words that describe matter (adjectives)
- Extensive Properties- only depends on the amount of matter
- Intensive Properties- only depends on the type of matter, not the amount
- Used to identify a substance

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States of matter

- Solid- mater that can not flow and has definite volume.
- Liquid- definite volume but takes the shape of its container (flows).
- Gas- a substance without definite volume or shape and can flow.
- Vapor- a substance that is currently a gas but normally is a liquid or solid at room temperature.

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States of Matter

	Definite Volume?	Definite Shape?	Temp. increase	Com-pressible?
Solid	YES	YES	Small Expans.	NO
Liquid	YES	NO	Small Expans.	NO
Gas	NO	NO	Large Expans.	YES

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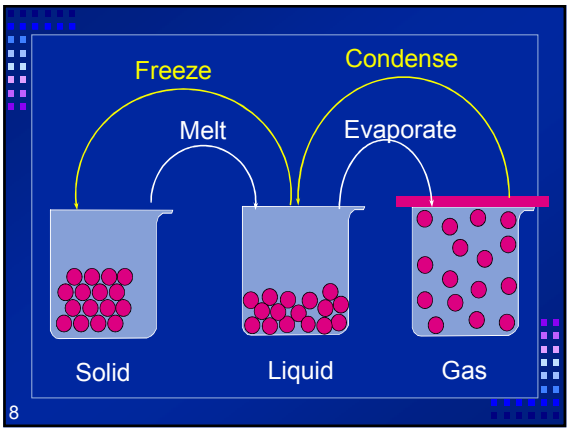

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States of Matter

- There are more
- Plasma
  - high temperature low pressure
  - electrons separate from nucleus
  - Most common in the universe

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Another Way to Change States

- Pressure
- For some substances it will turn solids to liquids
- For others it will turn liquids to solids
  - Silly putty
- Will turn gas to liquid-
  - Compressor in refrigerator and AC

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Physical Changes

- A change that changes appearances, without changing the composition.
- Examples?
- Chemical changes - a change where a new form of matter is formed.
- Also called chemical reaction.
- Examples?
- Not phase changes
  - Ice is still water.

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Mixtures

- Made up of two substances.
- Variable composition.
- Heterogeneous- mixture is not the same from place to place.
- Chocolate chip cookie, gravel, soil.
- Homogeneous- same composition throughout.
- Kool-aid, air.
- Every part keeps its properties.

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Separating mixtures

- Only a physical change- no new matter
- Filtration- separate solids from liquids with a barrier
- Distillation- separate because of different boiling points
  - Heat mixture
  - Catch vapor in cooled area
- Chromatography- different substances are attracted to paper or gel, so move at different speeds

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Chromatography

Fig.1. Genomic xHif DNA run on a 1.2% agarose gel and digested with BamHI, EcoRI, HindIII, SalI, and XhoI. DNA bands corresponding to EcoRI 2,000 base pair fragment and HindIII 4,000 base pair fragment (circled) were excised and the DNA isolated and sequenced.

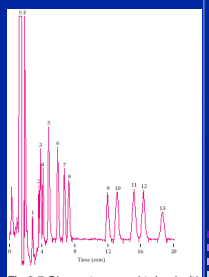

Fig 2.7 Chromatogram obtained with Electrochemical Detector

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Solutions

- Homogeneous mixture
- Mixed molecule by molecule
- Can occur between any state of matter.
- Solid in liquid- Kool-aid
- Liquid in liquid- antifreeze
- Gas in gas- air
- Solid in solid - brass
- Liquid in gas- water vapor

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Solutions

- Like all mixtures, they keep the properties of the components.
- Can be separated by physical means
- Not easily separated- can be separated without creating anything new.

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Substances

- Elements- simplest kind of matter
- Cannot be broken down into simpler
- All one kind of atom.
- Compounds are substances that can be broken down by chemical methods
- When they are broken down, the pieces have completely different properties than the compound. Salt
- Made of molecules- two or more atoms stuck together

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Compound or Mixture

Compound	Mixture
One kind of piece- Molecules	More than one kind - Molecule or atoms
Making is a chemical change	Making is a physical change
Only one kind	Variable composition

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Which is it?

Element Compound Mixture

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Chemical Reactions

- Another name for chemical change
- When one or more substances are changed into new substances.
- Reactants- stuff you start with
- Products- What you make
- NEW PROPERTIES
- Because each substance has its own properties

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Indications of a chemical reaction

- Energy absorbed or released
- Color change
- Odor change
- Precipitate- solid that separates from solution
- Not easily reversed
- Only clues not certainty

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Chemical symbols

- There are 116 elements
- Each has a 1 or two letter symbol
- First letter always capitalized second never
- Don't need to memorize
- Some from Latin or other languages

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Chemical symbols

- Used to write chemical formulas
- Subscripts tell us how many of each atom
- H_2O
- C_3H_8
- $HBrO_3$

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Conservation of Mass

- Mass can not be created or destroyed in ordinary (not nuclear) changes.
- All the mass can be accounted for.
- Mass at the start = mass at end

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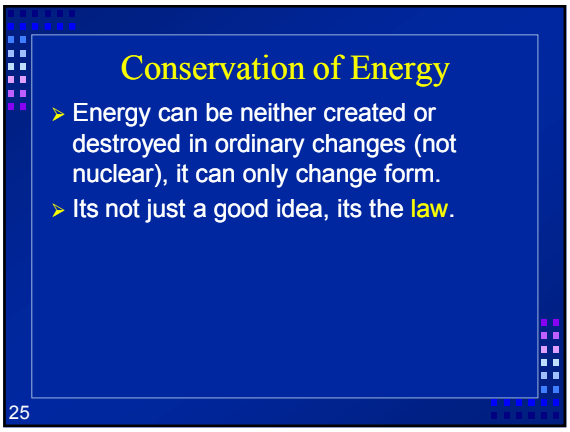
Conservation of Energy
Energy can be neither created or destroyed in ordinary changes (not nuclear), it can only change form.
Its not just a good idea, its the law.
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