



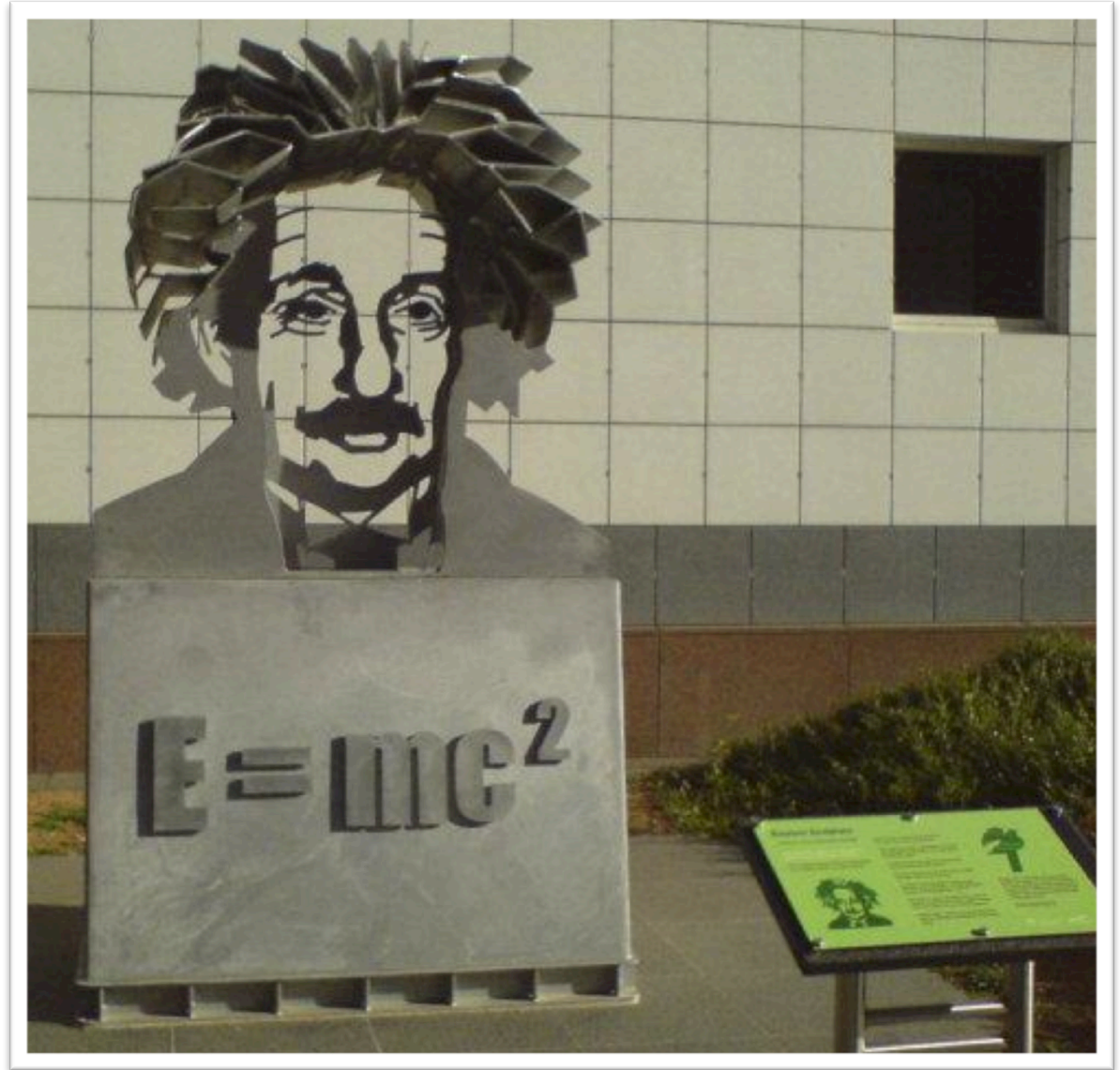
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- The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.
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- Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.
- Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.
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Matter & Energy



Chemistry

The basis of
all substances
in our world



Chemistry

- **The Study of Matter**

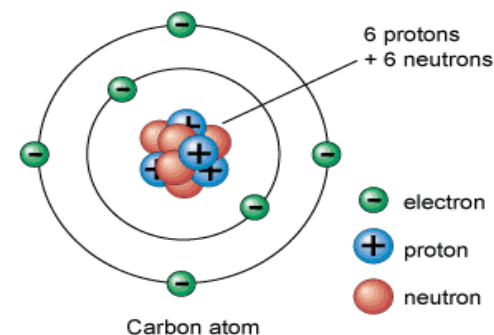
- Structure → what it's made of
- Properties → how it behaves
- Changes → how and why it changes

- **Matter** → anything that:

- Has mass
- Takes up space
- Most basic components are **ATOMS**

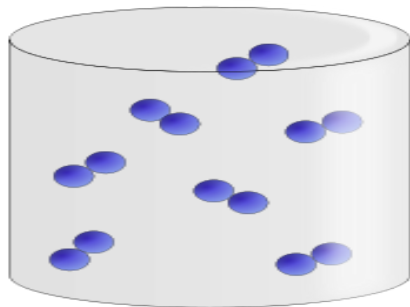
- **Substance**

- A particular type of matter, such as water or sugar



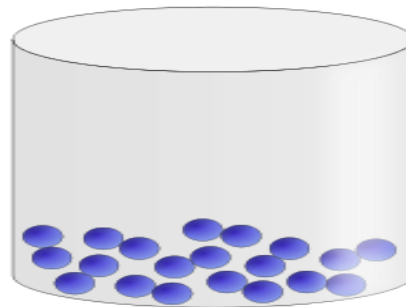
States of Matter

	Gas	Liquid	Solid
Shape	Whatever	Whatever	Definite
Volume	Whatever	Definite	Definite
Compressible?	Yes	No	No



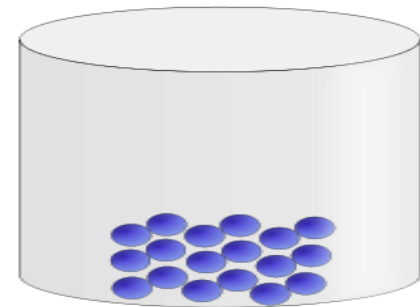
Gas

Molecules far apart and disordered, with little interaction



Liquid

Intermediate situation



Solid

Molecules close together and ordered, with strong interaction

Properties of Matter

Physical properties describe a substance.

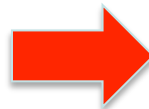
- Observed with our senses
 - Color, smell, texture
- State of matter at specific temperatures
 - Solid, liquid or gas at room temp?
- Examples
 - Density, boiling & freezing points, ability to mix or separate solutes and solvents.



These properties can be used to help ID a substance.

Density

The density of a marshmallow is about 0.4 g/ml



Density is a physical property.

Different materials can have different densities.

Density = weight/volume

Densities of Various Metals

- Aluminum = 2.70 g/mL
- Zinc = 7.13 g/mL
- Iron = 7.87 g/mL
- Copper = 8.96 g/mL
- Silver = 10.49 g/mL
- Lead = 11.36g/mL
- Gold = 19.32 g/mL



These values/properties can be used to help decide what kind of metal you have.

Physical Changes in Matter

Matter can change in physical appearance, but it is still the same substance.

Example: Water freezes or boils, but it is still water.

How do I know if a change is physical?

The substance can easily go back to previous form.

Other types of physical changes:

- Mixtures, such as sugar water solution
- Candle melting
- Breaking glass



Chemical Changes in Matter

The change of one substance into another that has a different chemical identity = **chemical reaction**

How do I know if a change is chemical?

It's difficult to get original substances back!

Example: Burning Wood

- change in the structure of matter (wood becomes ash and smoke)
- one substance is “used up” (wood is gone)
- others substance(s) “appear”(ash and smoke)



Another Example of a Chemical Change

- Change in color
- Production of a gas (bubbles or smoke)
- Change in temperature, production of heat
- Permanent change in the state of matter
- Can't easily get original substances back



Comparison of a Physical & Chemical Change

Mixture = Physical combination of two or more pure substances.

Compound = Chemical combination of two or more pure substances in a fixed, definite proportion.

Components of a mixture usually can be separated by physical means such as distillation, evaporation, etc.

Physical Mixture - Iron & Sulfur

Iron filings may be mixed with powdered sulfur in any proportion. The two components are easily separated by means of a magnet. The magnet will draw out the iron from the mixture.

Chemical Compound - Iron sulfide (Pyrite or Fools Gold)

- seven parts iron filings or powder are mixed with four parts powdered sulfur
- mixture is heated to a red glow
- iron and sulfur form a compound - iron sulfide (fool's gold); chemically combined, not readily separated.



Watch This!
[Mixture vs Compound](#)



[Click here](#) to watch some *amazing* chemical reactions!

Important Measurements We Will Be Using in Lab



Measurement	Metric Base Unit	English Unit
Mass (weight)	gram (g)	Oz., Pound, Ton
Volume	liter (L)	Tsp., Pint, Gallon
Length	meter (m)	Inch, foot, yard
Temperature	degree Celcius ($^{\circ}\text{C}$)	Fahrenheit ($^{\circ}\text{F}$)
Density = mass/volume	$\text{g/mL} = \text{g/cc}$	lb/gallon

Chemistry also studies

Energy

- **Capacity to do work**
(ex: move a car, move a muscle)
- **Commonly measured as calories .**
- **Symbols:**
E = Energy
KE = Kinetic Energy
PE = Potential Energy



In a typical lightning strike, electric potential energy is converted into the same amount of energy in other forms, most notably light energy, sound energy and thermal energy.

Kinetic vs. Potential Energy

Kinetic energy KE	Potential energy PE
<p>➤ Energy of motion</p> <p>➤ Examples:</p> <ul style="list-style-type: none">• Auto collision• Molecular motion of air blowing out candles• Arrow flying from drawn bow	<p>✧ “Stored” energy</p> <p>✧ Examples:</p> <ul style="list-style-type: none">✧ Momentum of car before impact✧ Energy contained in chemical bonds of food we eat✧ Energy in the drawn bow

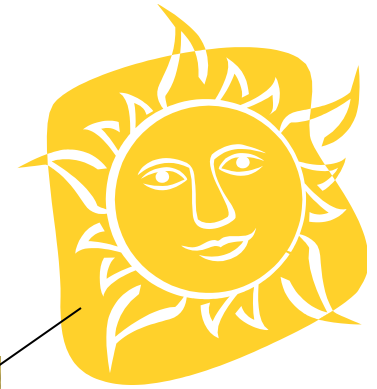
Everyday Science

Law of Conservation of Energy

- All energy in the universe is constant (cannot be created or destroyed).
- But energy can be converted between forms.
- *Amount of E is constant.*
- *Form of E is not.*
- **Example:** When archer draws the string back, **chemical energy** of the archer's body is transformed into elastic **potential energy** in the bent bow. When the string is released, potential energy in the bow is transformed into **kinetic energy** of the arrow as it takes flight.



Energy Exchange in an Ecosystem



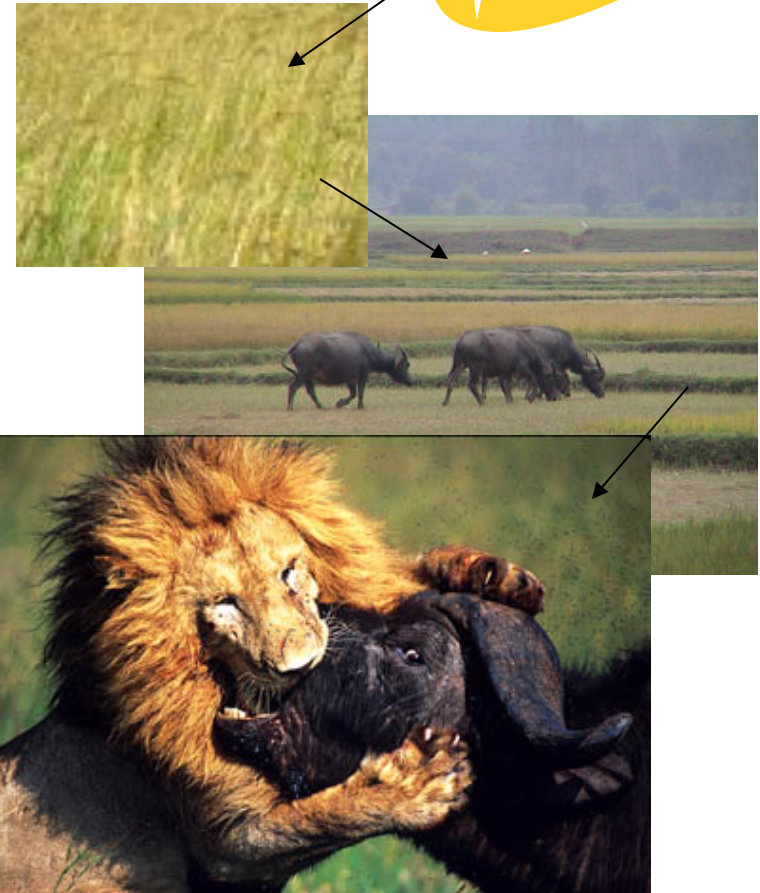
Solar energy powers most life on earth.

Plants convert sunlight energy into PE stored as calories in the chemical bonds of sugars (food).

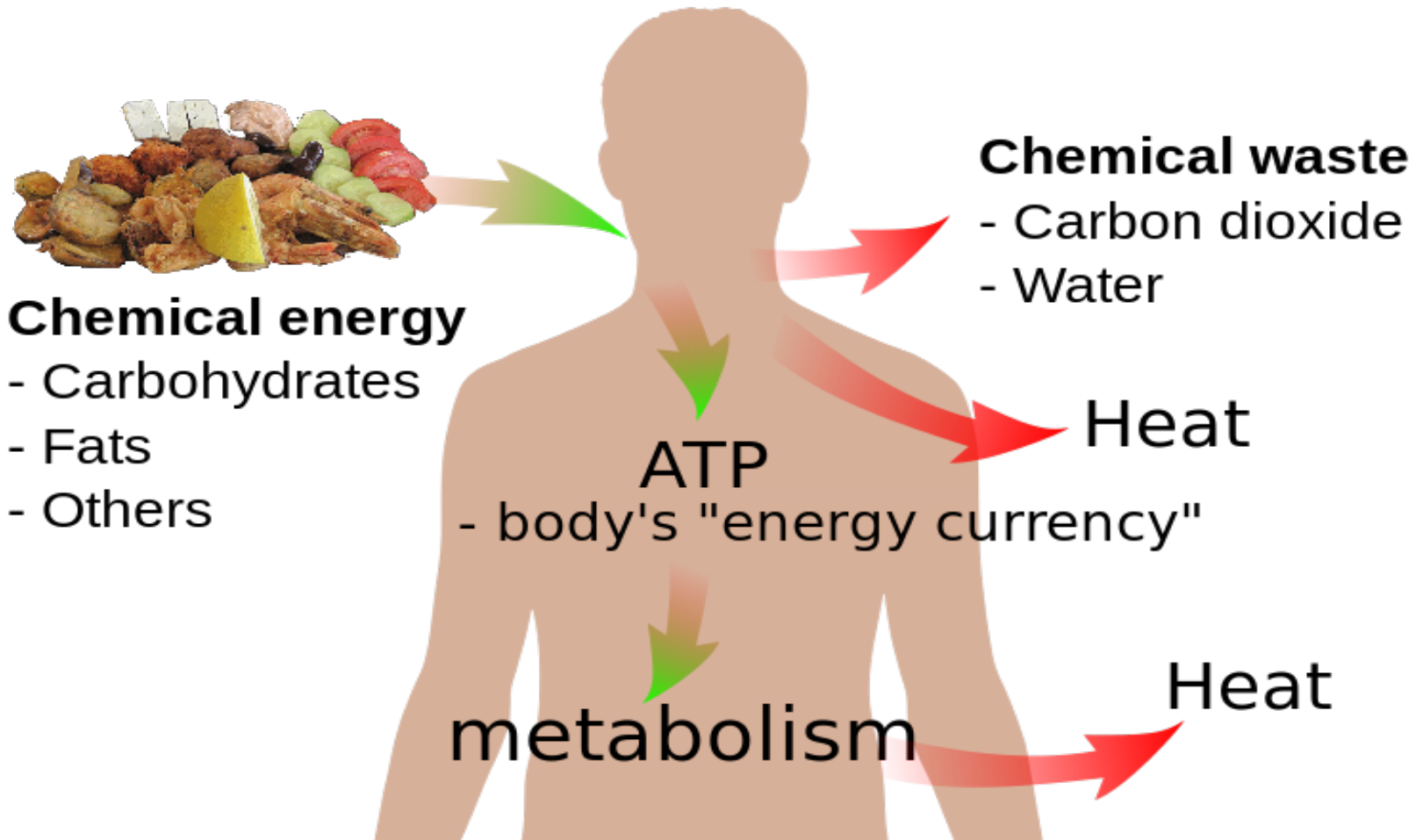
Animals eat plants, or other animals, and transform the PE of food calories into the energy of body heat, movement, and the cellular work needed to stay alive.

♪ It's the circle...the circle of LIFE ♪

The cycling of matter as nutrients.
The flow of energy thru the food chain.
Amount of energy is constant, form is not.



Energy and human life



Confused?

Here are some links to fun resources that further explain Chemistry:

- [Matter Is the Stuff Around You](#) from Chem4Kids.
- [Inorganic Chemistry Main Page](#) on the Virtual Cell Biology Classroom of [Science Prof Online](#).
- ["Chemistry"](#) a song by Kimya Dawson.
- [Chem4Kids](#) website by Rader.
- ["Better Living Through Chemistry"](#) a song by Queens of the Stone Age.
- ["Chemistry"](#) a song by Rush.

(You must be in PPT slideshow view to click on links.)

Smart Links

