Lab Report Heading

- Top right corner

Hour-group

Name

Date

Group member's names

2-9

Ima Gooden

9/6/19

Hugo First

Ida Nough

Observations

- What, not Why
- Simply a record of what was observed (**data**)
- Made DURING the experiment

Reporting Data…

- Data implies measurements taken during the procedure
- CALCULATED VALUES ARE NOT DATA!
- *Data should be reported in table form whenever possible*
  - *Not paragraph form*

Conclusions

- Why, not What
- A statement of the cause behind the event
- Made AFTER the experiment

Don't forget to return your Lab Safety Contracts signed by yourself and a parent or guardian as soon as possible.

Science

- from Latin *scientia*, from *scire*
- 'knowledge'
  - conscience = with knowledge
  - omniscience = all knowledge
  - prescience = knowledge beforehand
- **Science is, by definition, a study of "what is known"**

Scientific Thinking

- logical and rational
  - law of causality
  - law of noncontradiction
- characterized by both **inductive** and **deductive** reasoning

Inductive reasoning is the primary methodology of science, that is, it is the **Scientific Method**

1. State question or problem
2. Conduct research
3. Form hypothesis
4. Conduct experiment
   - *should test the hypothesis*
5. Analyze results
6. Form conclusion (Theory)

- **Induction** starts with concrete data, then draws generalized conclusions (theories) from that data.

Example:

Data: in general, the universe appears to be expanding as time goes by

Conclusion: the universe must have at one time been a single point and is expanding out from that point

Induction has a key feature : **you can have true premises and false conclusions**.

- ✓ Even if all of your evidence suggests something is true, your conclusion does not follow as a *logical necessity*.
- ✓ In simple language: **you may be wrong**

Whenever new data arise, theories have to change accordingly.

- **Deductions** are based on true premises, and drawn from logical necessity

Example:

Premise A: Aqueous solutions of Cu^{2+} are blue

Premise B: Dissolving $CuSO_4$ in water produces an aqueous solution of Cu^{2+}

Conclusion: Dissolving $CuSO_4$ in water produces a blue solution

- **Deduction** is also the methodology of math
- Deduction is powerful in its certainty, but isn't always possible
  - Depends on the availability of premises known with certainty
- Most of our knowledge is gained through inductive reasoning
- **Inductive** thinking gives rise to **THEORIES**
- **Deductive** thinking results in **LAWS**

Theory

- an explanation of how or why that has been successfully tested
- *can never be proven*
- are **accepted** as true until disproven
- provide predictive powers

Law

- describes or states the "what", *doesn't explain*
- a summary of the results of many observations or experiments
- often math equations

Chemistry

The study of matter, its properties, and the changes it undergoes.

matter

- Anything that has mass and takes up space
- Three types

1. Elements
2. Compounds
3. Mixtures

} Pure substances (aka “chemicals”)

What does **pure** mean?

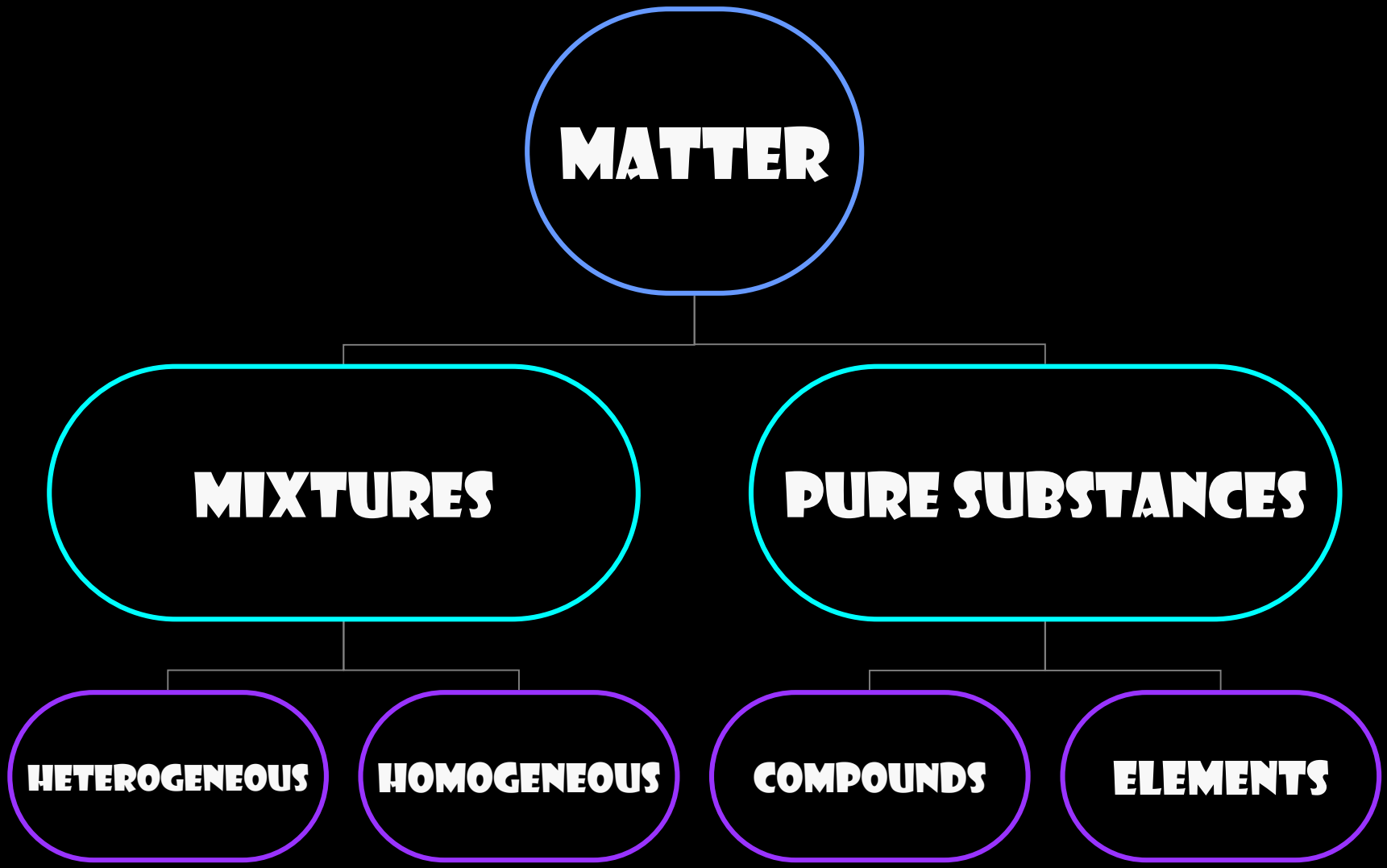
- In chemistry, pure ≠ “clean”
- Pure means
  - only one substance
  - unmixed
- There is no such thing as a “pure mixture”!

Types of mixtures

- Determined by how well the substances are mixed together

1. Homogeneous mixtures
   - Uniform throughout
2. Heterogeneous mixtures
   - Non-uniform

Matter flowchart



properties

- The characteristics that describe or help identify a substance
- Can be chemical or physical

Chemical properties

- Describe how a substance reacts chemically
- Examples:
  - Combustibility
  - Rusting (oxidation)
  - Reaction with an acid

Chemical properties

- Key idea:
- Chemical properties can only be observed by changing the substance into a new, different substance

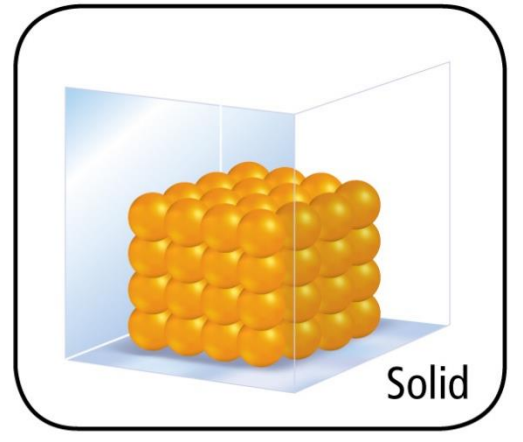
Physical properties

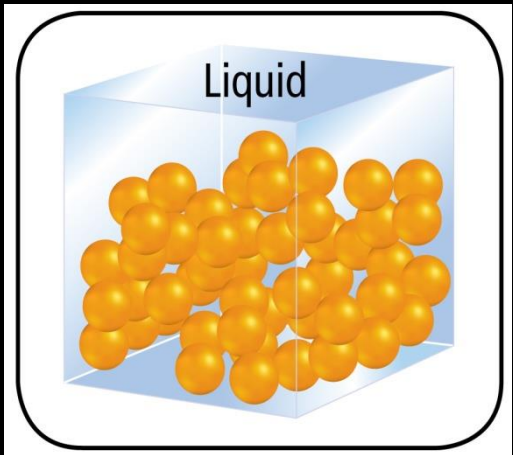
- Describe the appearance of a substance
- Can be observed without changing the substance into a new, different substance

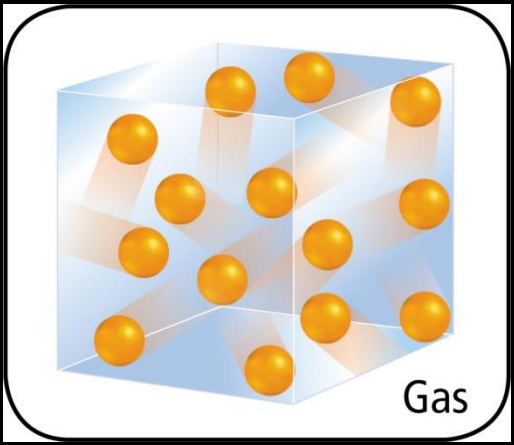
Physical properties - examples

- Color
- Odor
- Size
- Mass
- Weight
- density
- Melting point
- Boiling point
- Physical state
  - Solid
  - Liquid
  - Gas
- solubility

Physical States of matter







- Intensive physical properties
  - ➔Do not depend on the sample size
  - ➔examples: temperature, density, color, solubility, physical state, melting/boiling point
- Extensive physical properties
  - ➔are sample size dependent
  - ➔examples: mass, volume, size

Chemistry is the study of…

- Matter, its properties, and the
- Changes it undergoes
- There are two types of changes
  - Chemical
  - physical

Chemical changes

- Result in the formation of new substances
- Examples
  - Elements $\rightarrow$ compounds
  - Burning, oxidation, acid reactions
- Usually called “chemical reactions”

Chemical changes Indicators

1. Changes in color
2. Changes in odor
3. New physical state formed (not just melting or freezing)
   a) New solid – precipitation
   b) Bubbles – new gas being produced
4. Change in temperature without using outside mechanism (burner, freezer)

Reaction Notation

- Reactants ➔ Products
- physical state often indicated

✓ solid = (s) ex: ice = $H_2O_{(s)}$

✓ liquid = (l)

✓ gas = (g) ex: steam = $H_2O_{(g)}$

✓ aqueous = (aq) = dissolved in water

Physical changes

- Do not result in the formation of a new, different substance
- Changes of physical state are physical changes
- Example: paper changes

Day 1 Lab – how to finish

1. List your observations (done)
2. Based on your observations, conclude whether there was only a physical change or both a physical *and* chemical change, or neither – **cite evidence**!
3. Staple to homework and hand in with them

Collaboration

Get observations for the procedures that your group did not do from a group that did!

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elements

- Matter that cannot be broken down into simpler substances by ordinary chemical means
- Example – “Lego” blocks

elements

- There are 118 known
- There are 94 naturally occurring
- All have unique name and symbol
  - 1 letter = capitol
  - 2 letters = cap w/ lower case
  - ex: B, C, Ca, Na

Some element names and symbols do not match - Latin names

- Na = sodium
- Latin: natrium
- K = potassium
- Latin: kalium
- Au = gold
- Latin: aurum
- Ag = silver
- Latin: argentum
- Hg = mercury
- Latin: hydrargentum
- Fe = iron
- Latin: ferrum

Some element names and symbols do not match - Latin names

- Pb = lead
- Latin: plumbum
- Sn = tin
- Latin: stannum
- Cu = copper
- Latin: cuprum
- Sb = antimony
- other: stibium
- W = tungsten
- Swedish

Names and symbols of the elements

- You will **not** have to memorize the names and symbols of ***all*** the elements
- For now – *start learning the names and symbols of elements 1 – 30* (H – Zn)

compound

- A substance made of two or more elements chemically combined
- The properties of a compound are different than the properties of the elements that make up the compound

Sodium (Na)

Sodium (Na)

https://dir.indiamart.com/mumbai/sodium-metal.html

Sodium (Na)

https://dir.indiamart.com/mumbai/sodium-metal.html

Chlorine (Cl_2)

Sodium (Na)

https://dir.indiamart.com/mumbai/sodium-metal.html

Chlorine (Cl_2)

https://swh-826d.kxcdn.com/wp-content/uploads/2011/06/Chlorine_gas.jpg

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Chlorine (Cl_2)

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sodium chloride NaCl (table salt)

https://sc01.alicdn.com/kf/UT8L0VEXThXXXagOFbXd/Sodium-Chloride.jpg

mixtures

- Elements and compounds (chemicals) *blended together*, but *not chemically combined*
- The chemical properties of the substances do not change
- No new chemicals are produced

Mixtures are separated PHYSICALLY

-these are all <u>physical changes</u>

- Filtration
  - based on differences in solubility
- Distillation
  - Based on differences in boiling points
- Crystallization
  - Separate pure solids out of a solution
- Chromatography
  - Based in differences in flow rate through special papers or substances

How to read the volume of a liquid in a graduated cylinder

How to read the volume of a liquid in a graduated cylinder

The **meniscus** is the U-shaped "the upper surface of a liquid in a tube".

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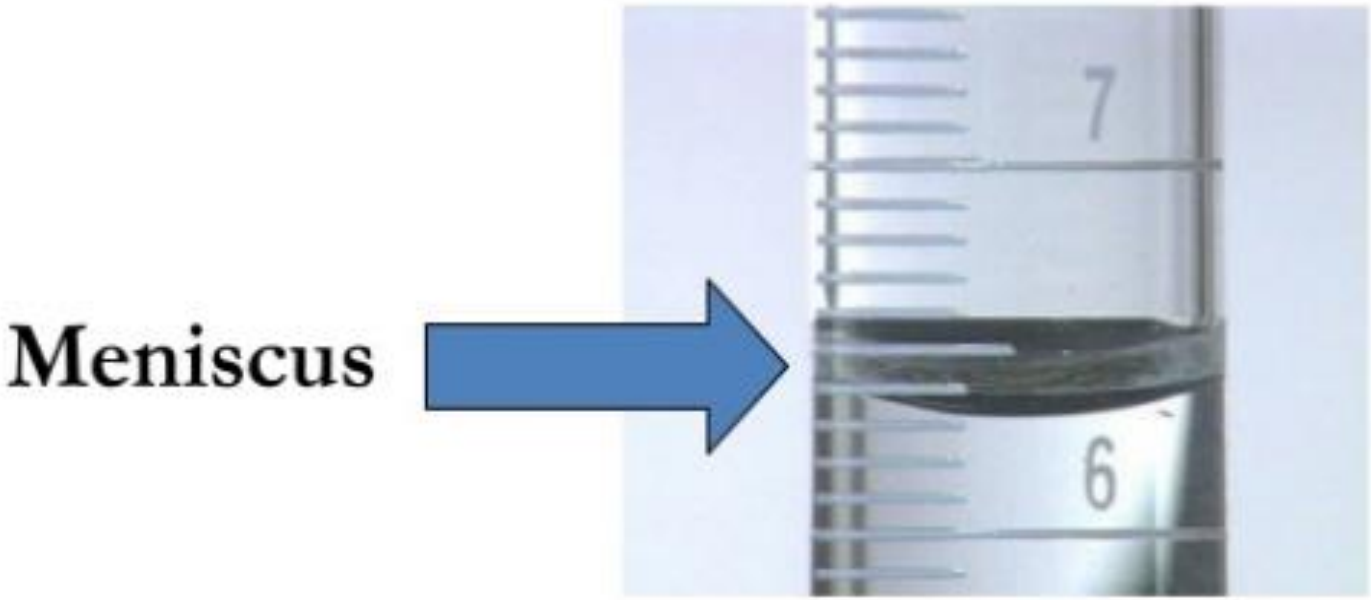

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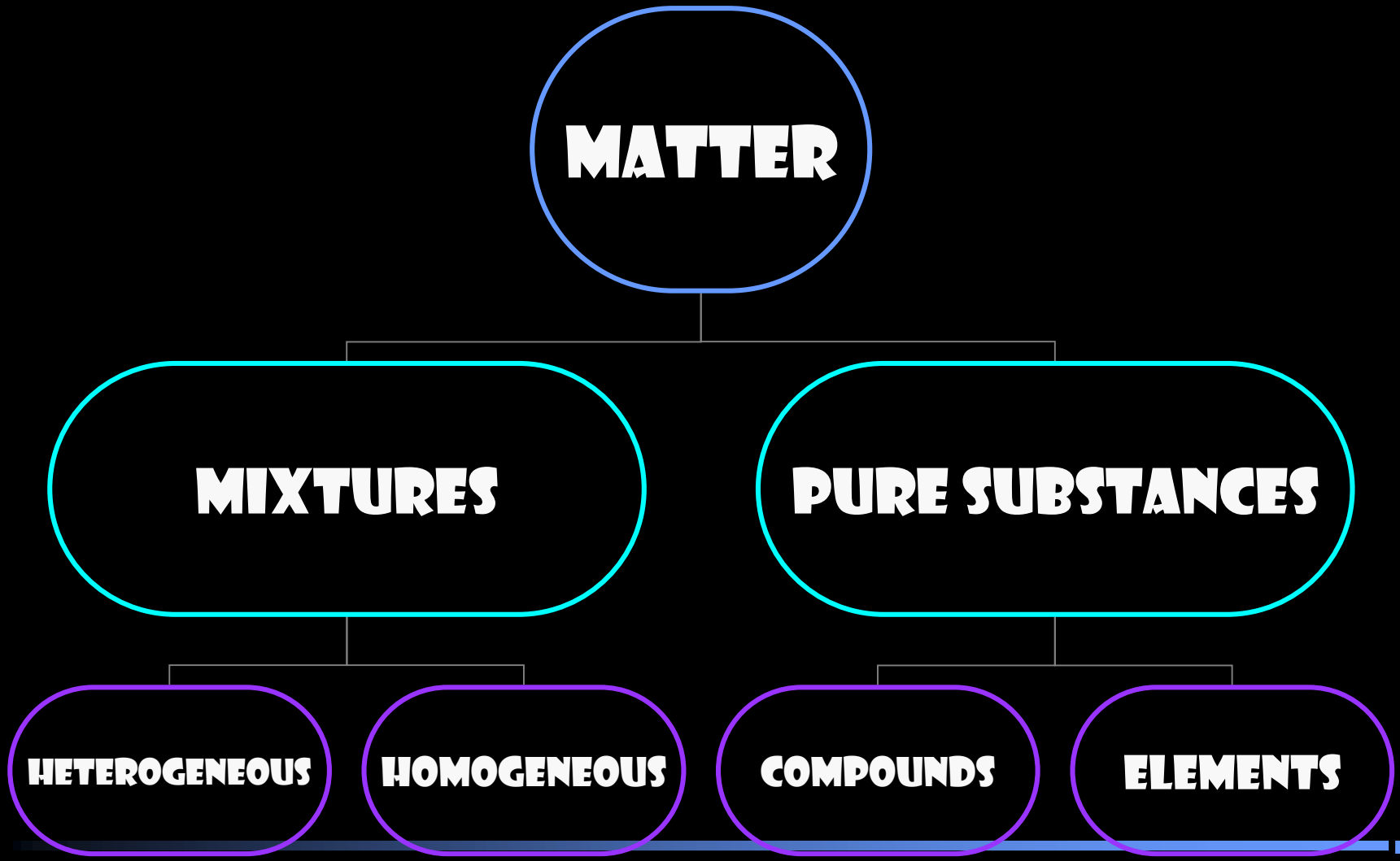

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Please switch from the fill-in-the-blank sheets to your notebooks now…

ENERGY

- The ability to do work
- Work = Force x distance in the direction of the force

A few examples of some forms of energy…

- Nuclear
- Electrical
- Solar (light)
- Chemical
- Heat
- mechanical

Types of energy

- Potential
  - Related to making and breaking attractive forces
  - ex: chemical
- Kinetic
  - Due to motion
  - ex: heat

Chemical reactions always involve energy changes!

What is the connection?

- $E = mc^2$
- E = energy
- m = mass
- C = the speed of light

Chemistry

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