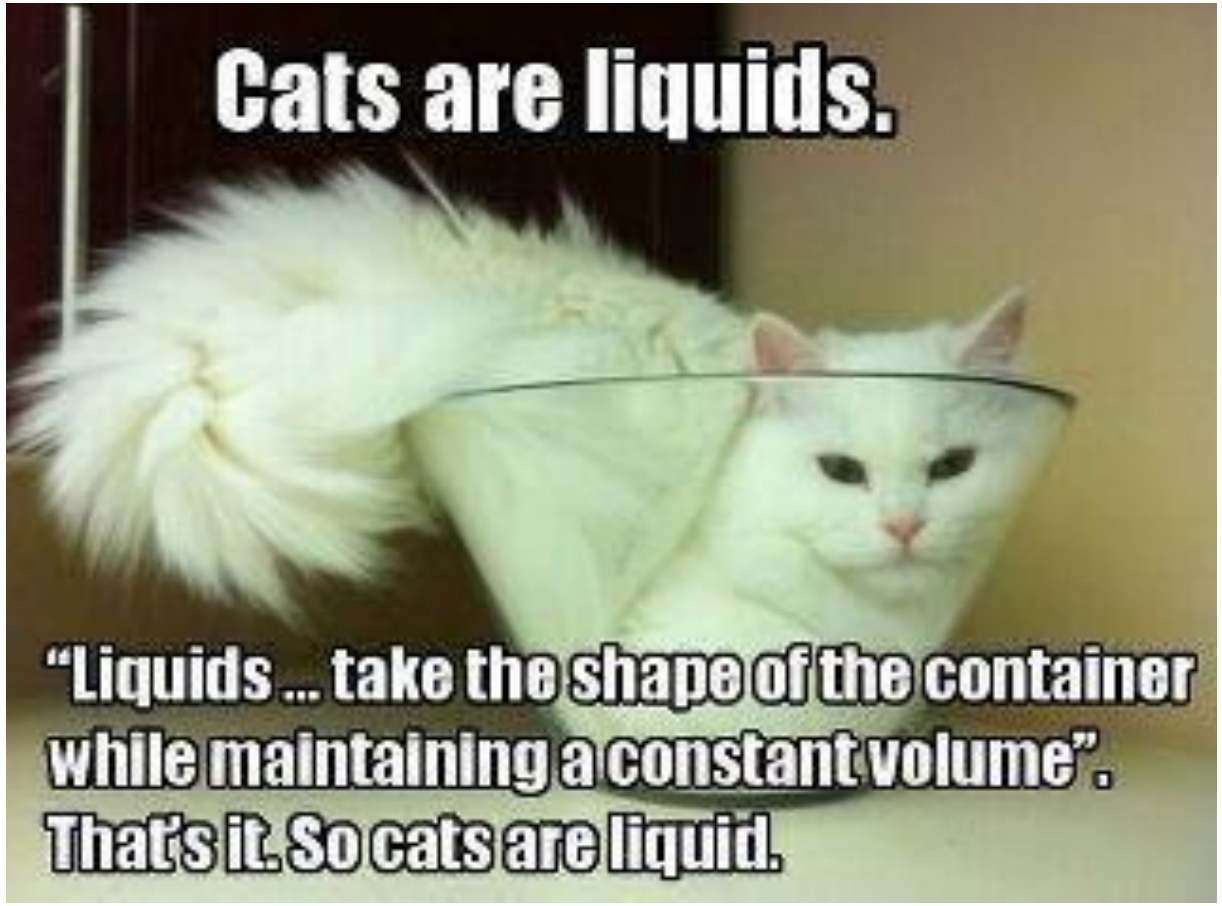
Physical Properties & Changes Intro



Outcome:

Describe the properties of gases, liquids, solids and plasma. *Include: density, compressibility, diffusion.*

Properties of Matter…

Physical Properties:

- Properties that can be observed with the **SENSES**, and can be determined without **DESTROYING** the object.
- **COLOUR**, **MASS**, **HARDNESS**, **MELTING**/**BOILING POINT**, **CONDUCTIVITY**, etc. are all physical properties.

Chemical Properties:

- The **ABILITY** of a substance to **CHEMICALLY REACT** to form **NEW SUBSTANCES**.
- **Must** undergo a **CHEMICAL CHANGE** in order to be **OBSERVED**.
- **COMBUSTIBILITY**, **REACTION** with **ACID**/**BASE**, etc.

Changes in Matter…

Physical Changes:

- **IDENTITY** of the substance **DOES NOT CHANGE**, is simply a **CHANGE** in **FORM**/**STATE**.
- **NEW PROPERTIES** may be observed, but **PARTICLES** of substance **HAVE NOT CHANGED**.
- **ICE MELTING**, **TEARING PAPER**, etc.

Chemical Changes:

- A **NEW SUBSTANCE** is **FORMED** with **NEW PROPERTIES**.
- May be **DIFFICULT** or **IMPOSSIBLE** to **REVERSE**.
- **MASSES** may **CHANGE**, **TOTAL MASS** does **NOT**.
- **PAPER BURNING**, **Zn in HCl,** etc.

Changes in Matter…

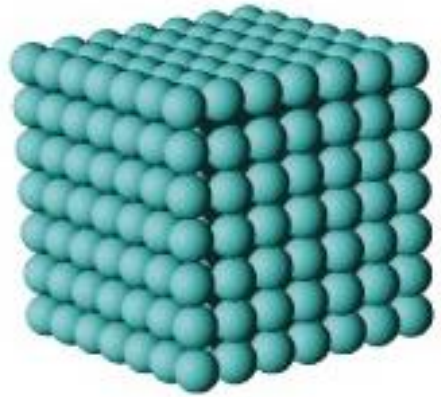
Signs of a Chemical Change

1. Bubbles of gas appear.
2. A precipitate forms.
3. A color change occurs.
4. The temperature changes.
5. Light is emitted.
6. A change in volume occurs.
7. A change in electrical conductivity occurs.
8. A change in melting point or boiling point occurs.
9. A change in smell or taste occurs
10. A change in any distinctive chemical or physical property occurs.

The Physical States of Matter…

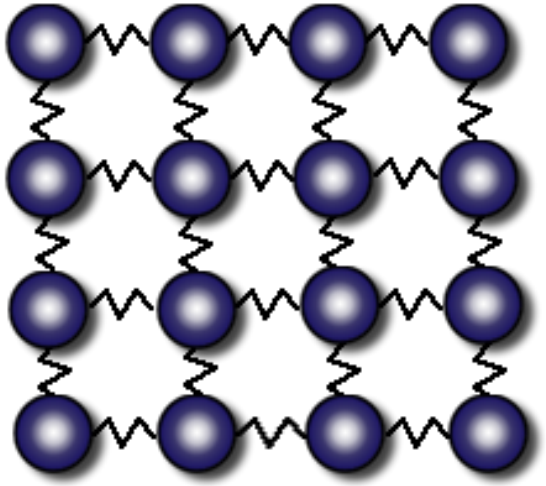
There are 3 different major states of matter: Video Bill Nye – States of Matter

1. **Solid**
   - Has definite **SHAPE** and **VOLUME** (**HOLDS OWN SHAPE**).
   - **CONSTANT** size and shape.
   - **TEMPERATURE** & **PRESSURE** have **LITTLE EFFECT**.
   - **NOT** easily **COMPRESSED**.
   - **NO DIFFUSION**.
   - **HIGH DENSITY**.



→ ***Solid particles have only vibrational motion.***

Animation

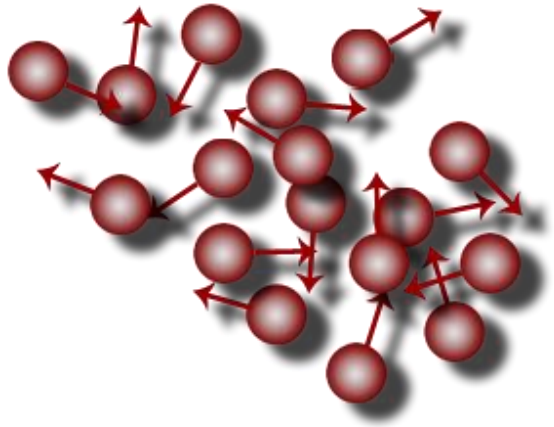


The Physical States of Matter…

2. Liquid

- Has a **DEFINITE VOLUME**.
- **NO** definite **SHAPE** → **TAKES** the **SHAPE OF** its **CONTAINER**.
- May be **COMPRESSED SLIGHTLY**.
- **PARTICLES** are **NOT AS CLOSE** together as is solids.
- **PARTICLES** can **MOVE** over each other quite easily.
- **HIGH DENSITY**.
- **NO DIFFUSION** (**OTHER SUBSTANCES** may **DIFFUSE** within a liquid)

→***liquid particles have vibrational, rotational, and translational motion (but are held together fairly tightly).***

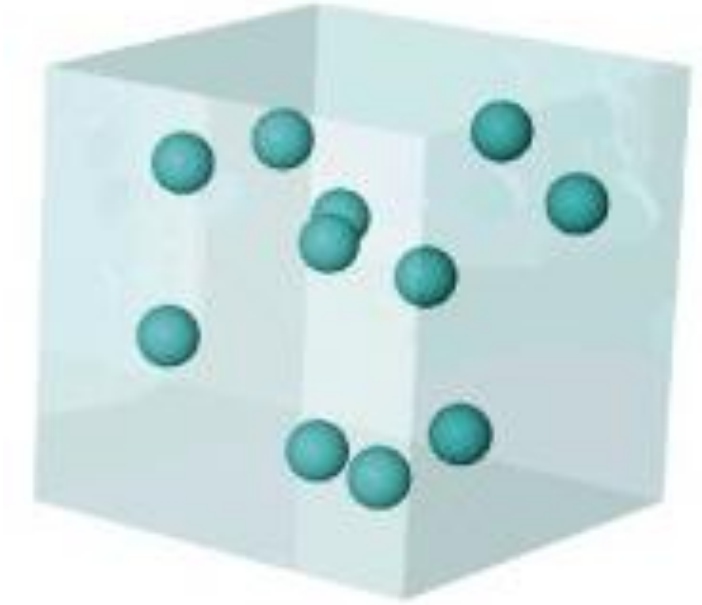


Animation

The Physical States of Matter…

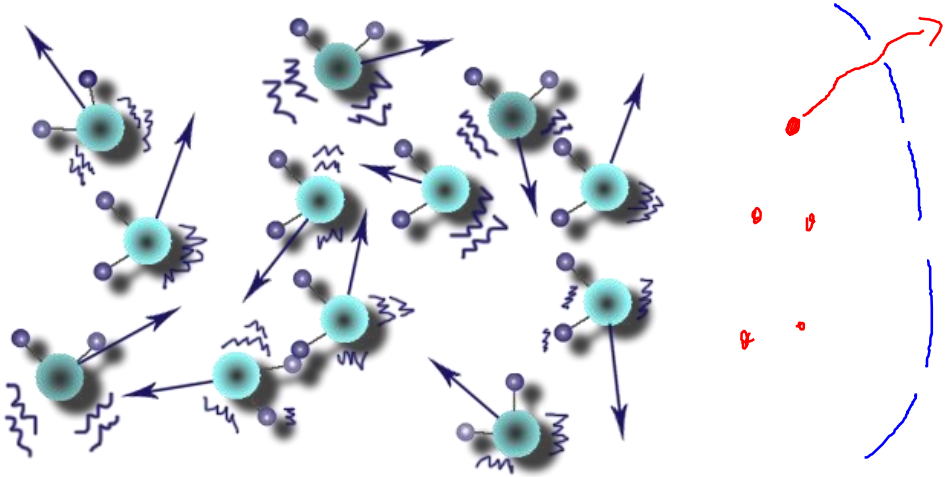
3. Gas

- Has **NEITHER DEFINITE VOLUME** nor **DEFINITE SHAPE**.
- Gases **EXPAND** to fill any space.
- **TEMPERATURE** and **PRESSURE** have **LARGE EFFECT**.
- Highly **COMPRESSABLE**.
- **LOW DENSITY**.
- **GASES** will **DIFFUSE** throughout a space.



→ ***Gas particles have vibrational, rotational, and translational motion with no forces holding them together***

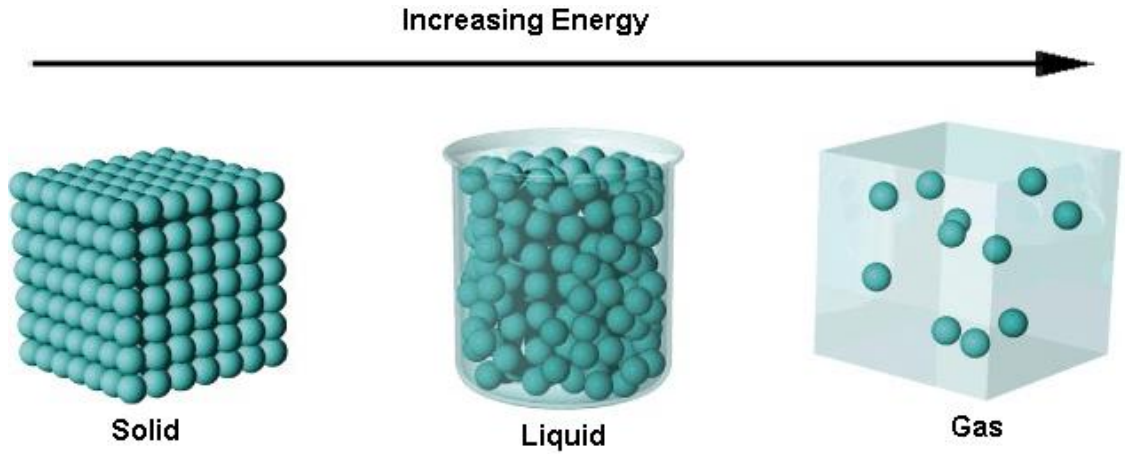
Animation



Changes of State…

A **CHANGE OF STATE** takes place when **ENERGY OR PRESSURE** is either **APPLIED** to, **OR** **REMOVED** from a substance.

The **ORDER** of **ENERGY** for particles in the three states is:



Changes of State:

Freezing **– From liquid to solid**

Melting – **Solid to liquid**

Evaporation **– liquid to gas**

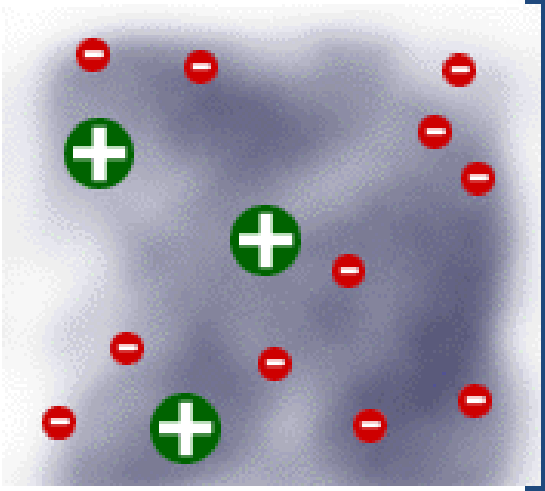
Condensing **– Gas to liquid**

Fourth State of Matter…

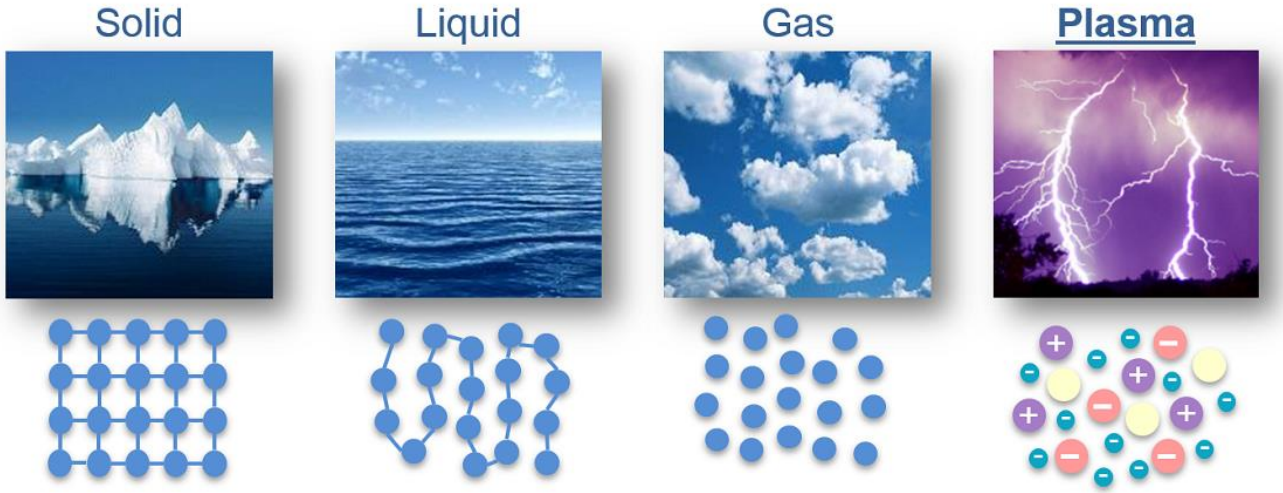
There is a fourth state of matter that we must look at…

4. Plasma

- Is a **GASEOUS** mixture of **POSITIVE IONS** and **ELECTRONS** (gas that has been **IONIZED**).
- Exist at very **HIGH TEMPERATURES** (>1 million °C)
- Have **LOW DENSITY**.
- **EXPAND** to fill its container.
- **PRESSURE** has an effect on density.
- **MOST ABUNDANT** state in the **UNIVERSE** (99%), **LEAST ABUNDANT** on **EARTH**.
- Examples: **STARS**, **LIGHTNING**, **NORTHERN LIGHTS**, **T.V.**'s.



Plasma video



http://www.grinp.com/plasma/physics.html

Other "Types" of Matter…

Not all forms of matter can be described as solids, liquids or gases:

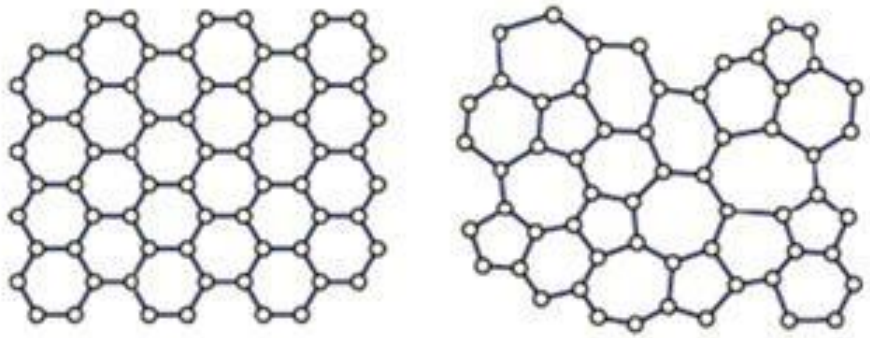
Liquid Crystals (LCD)

- Substances that **MAINTAIN** their **ARRANGEMENT** like a **SOLID**, but particles can **MOVE** around **LIKE** a **LIQUID**.

Plasma vs LCD tvs

Amorphous Materials

- Have an **IRREGULAR ARRANGEMENT** of particles.
- Do not have a definite **MELTING POINT** (ex. **GLASS**, **WAX**, **RUBBER**, **PLASTIC**, etc.)

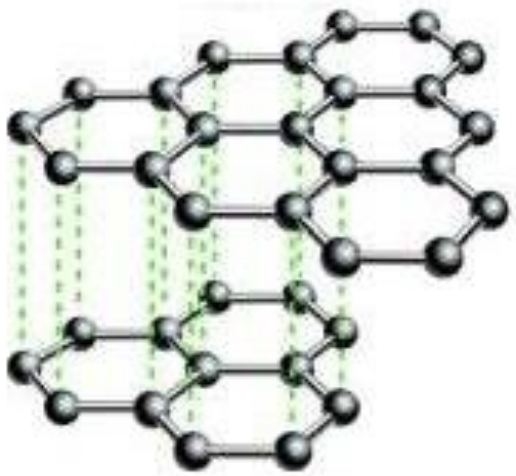


Crystalline Amorphous

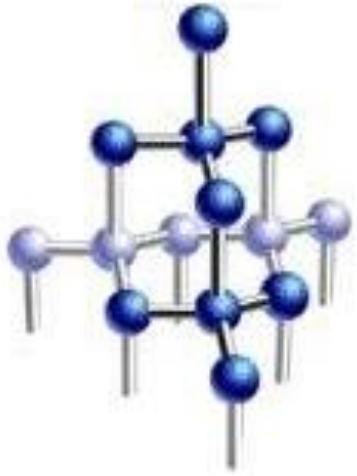
Other "Types" of Matter…

Allotropes:

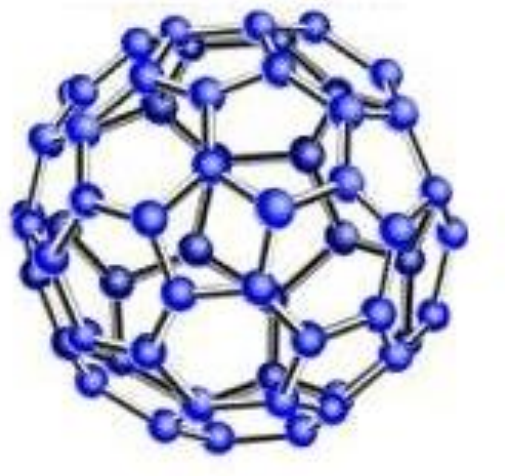
- **DIFFERENT** particle **ARRANGEMENTS** of the same substance.
- **CARBON** can exist as a **CRYSTAL** (**DIAMOND**), a **SHEET** (**GRAPHITE**), cage-like **BALLS** (**BUKMINSTERFULLERINES**), etc.



Graphite



Diamond



Buckminsterfullerine