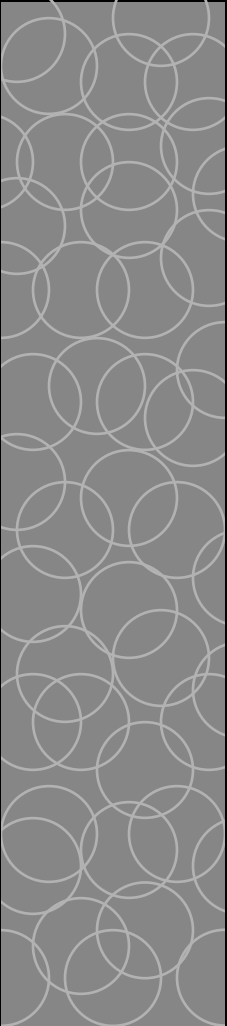


Matter



Essential Question

◆ What is
Matter?





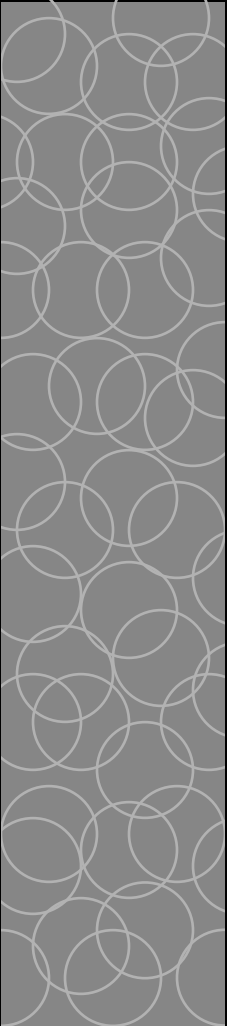
MATTER

— *anything that has mass and takes up space*

1. Matter is made up of tiny particles called atoms.
2. Substances that contain only one type of atom are elements.



What isn't matter?



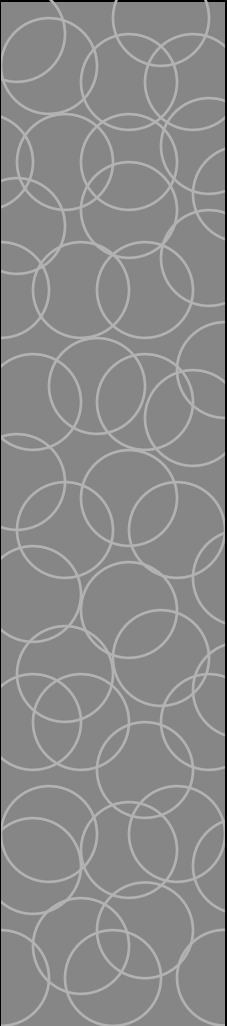
- ◆ Anything that does not have mass or take up space.
- ◆ Examples: heat, light, emotions, thoughts, ideas

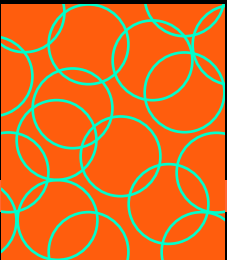
Law of Conservation of Matter

- ◆ Matter is not created nor destroyed---it only changes form.

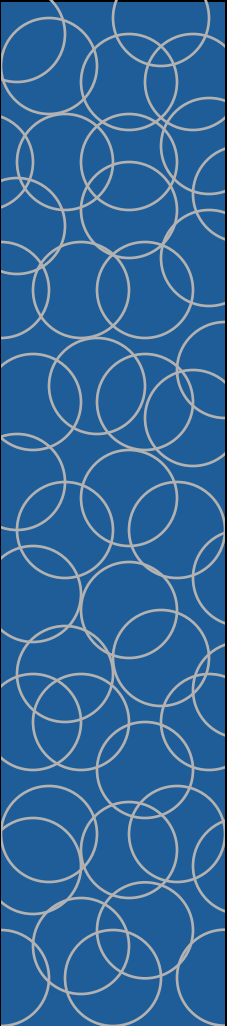


Law of Conservation of Mass

- 
- ◆ Mass is neither created nor destroyed in a chemical reaction.
- 



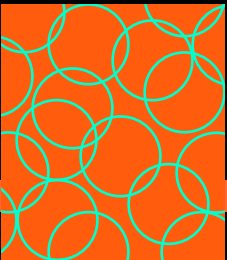
States of Matter



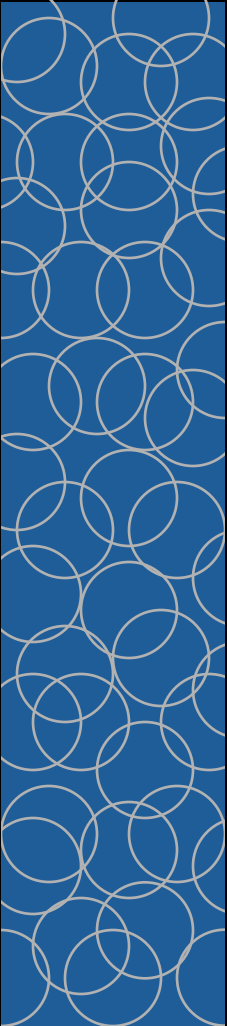
Chemistry

The Four States of Matter





States of Matter



The Four States of Matter

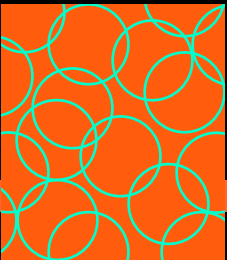
Four States

1 Solid

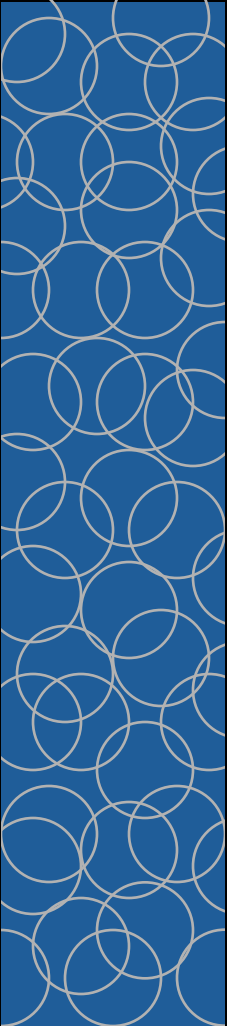
2 Liquid

3 Gas

4 Plasma



States of Matter



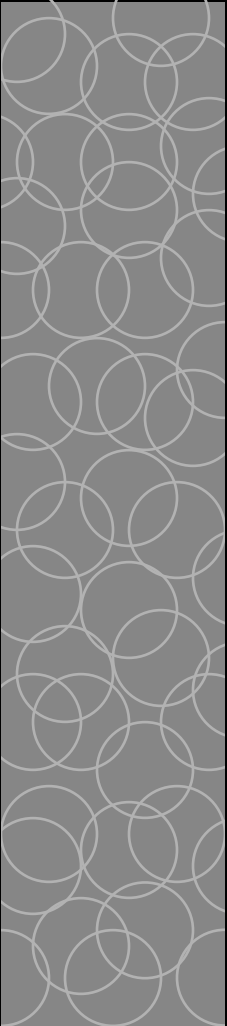
The Four States of Matter

Basis of Classification of the Four Types

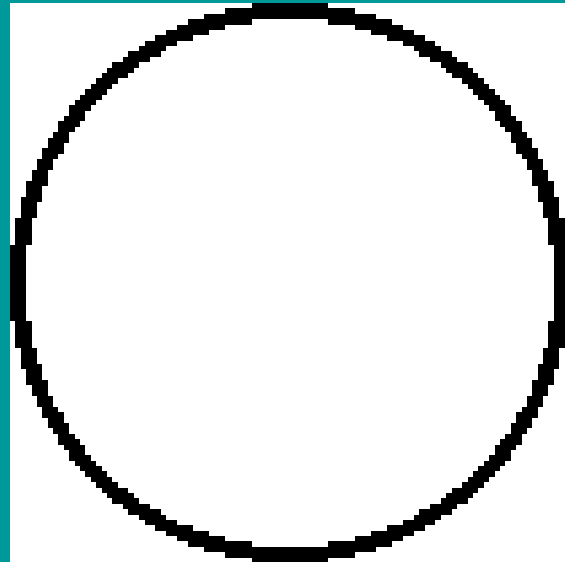
- Based upon particle arrangement
- Based upon energy of particles
- Based upon distance between particles

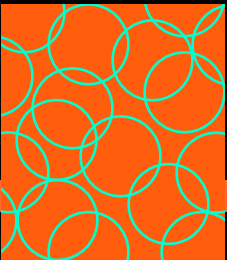


Kinetic Theory of Matter

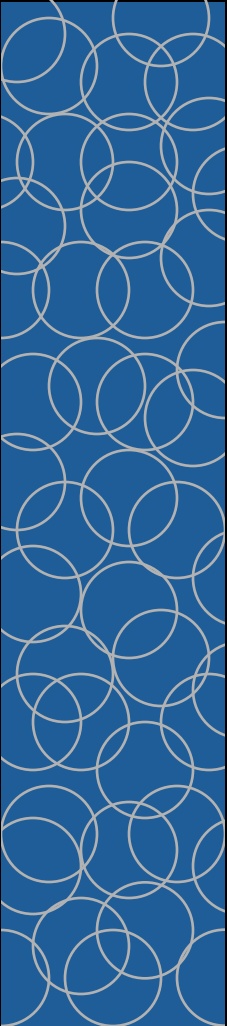


Matter is made up of particles which are in continual random motion.





States of Matter



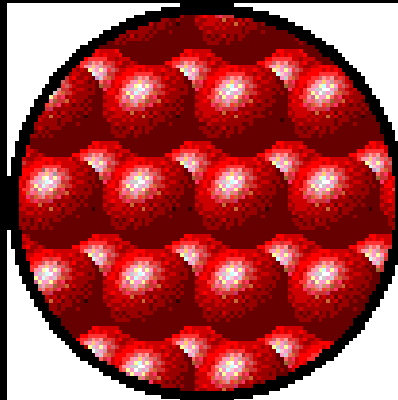
Solids

- Particles of solids are tightly packed, vibrating about a fixed position.
- Solids have a definite shape and a definite volume.
- Crystalline solids – molecules are arranged in a geometric pattern (ex. Table salt)
- Amorphous solids – molecules do not have a set pattern of arrangement (ex. Gels)

States of Matter

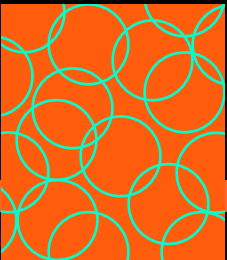
Solids

Particle Movement

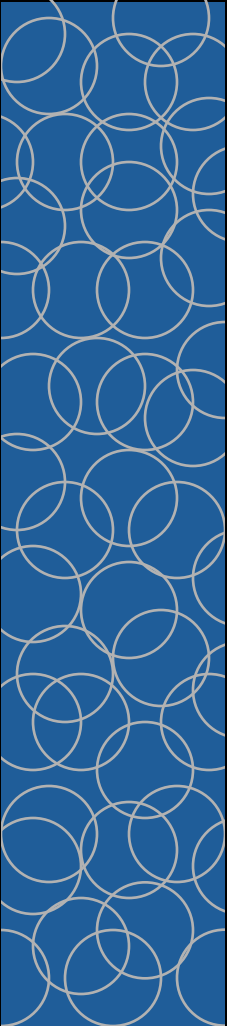


Examples





States of Matter



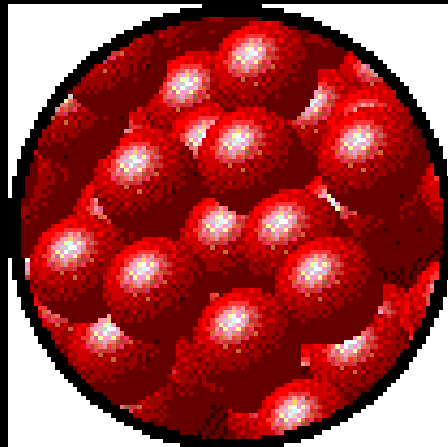
Liquids

- Particles of liquids are tightly packed, but are far enough apart to slide over one another.
- Liquids have an indefinite shape and a definite volume.

States of Matter

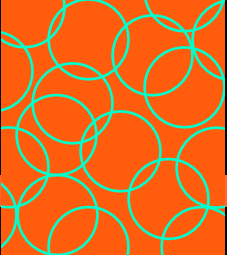
Liquids

Particle Movement

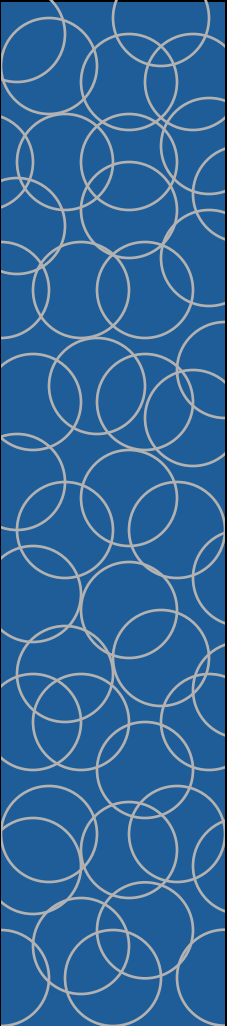


Examples





States of Matter



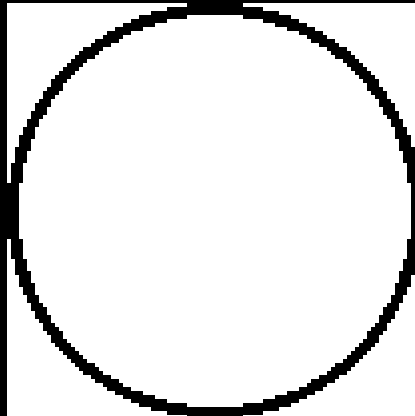
Gases

- Particles of gases are very far apart and move freely.
- Gases have an indefinite shape and an indefinite volume.

States of Matter

Gases

Particle Movement



Examples



PHASE CHANGES

**Description of
Phase Change**

**Term for Phase
Change**

**Heat Movement During
Phase Change**

**Solid to
liquid**

Melting

**Heat goes into
the solid as it
melts.**

**Liquid to
solid**

Freezing

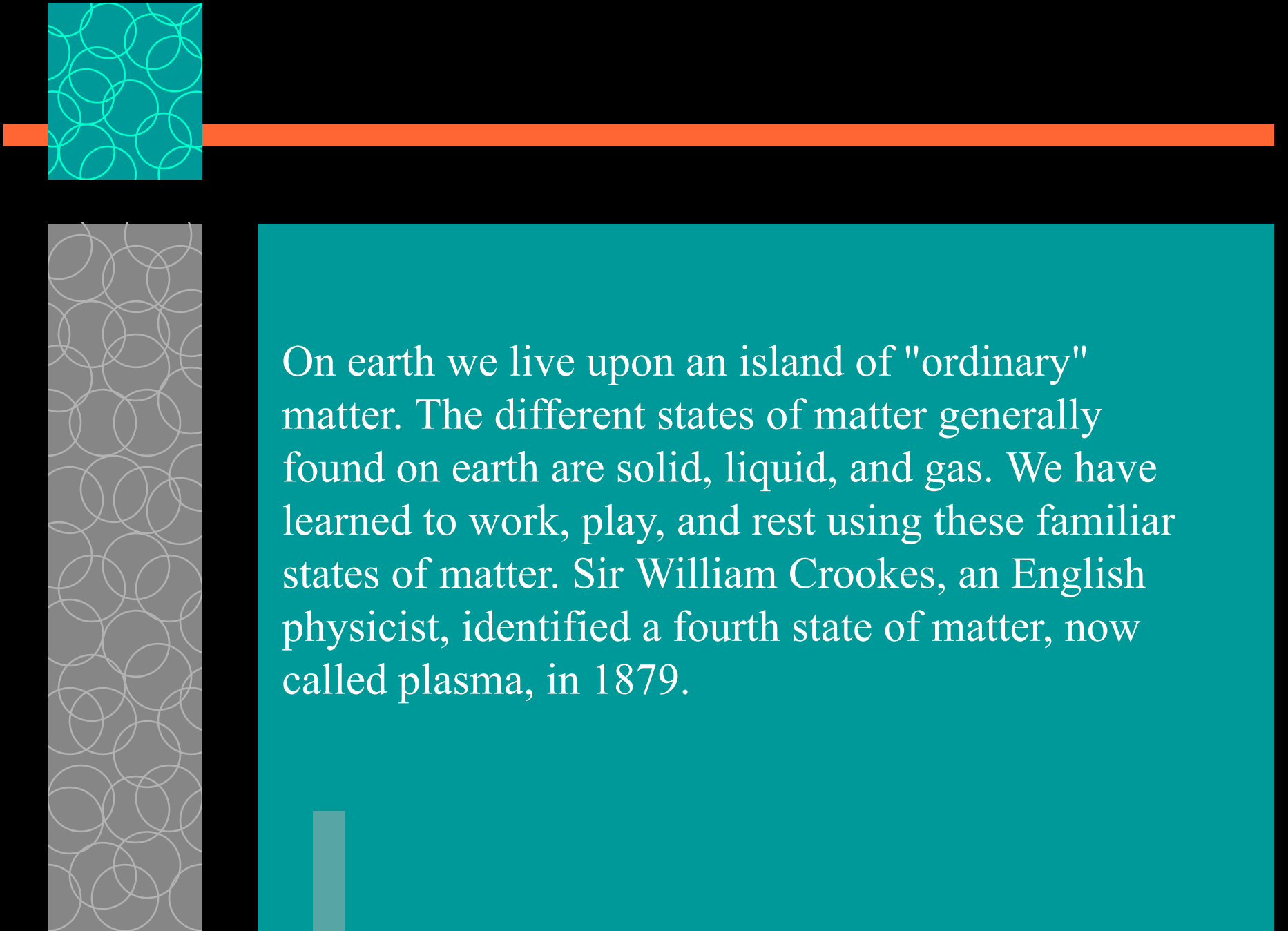
**Heat leaves the
liquid as it
freezes.**

PHASE CHANGES

Description of Phase Change	Term for Phase Change	Heat Movement During Phase Change
Liquid to gas	Vaporization, which includes boiling and evaporation	Heat goes into the liquid as it vaporizes.
Gas to liquid	Condensation	Heat leaves the gas as it condenses.
Solid to gas	Sublimation	Heat goes into the solid as it sublimates.

But what happens if you raise the temperature to super-high levels... between 1000°C and 1,000,000,000°C ?

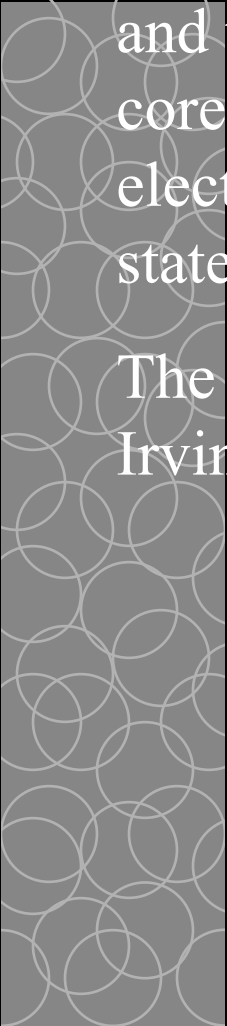
Will everything just be a gas?



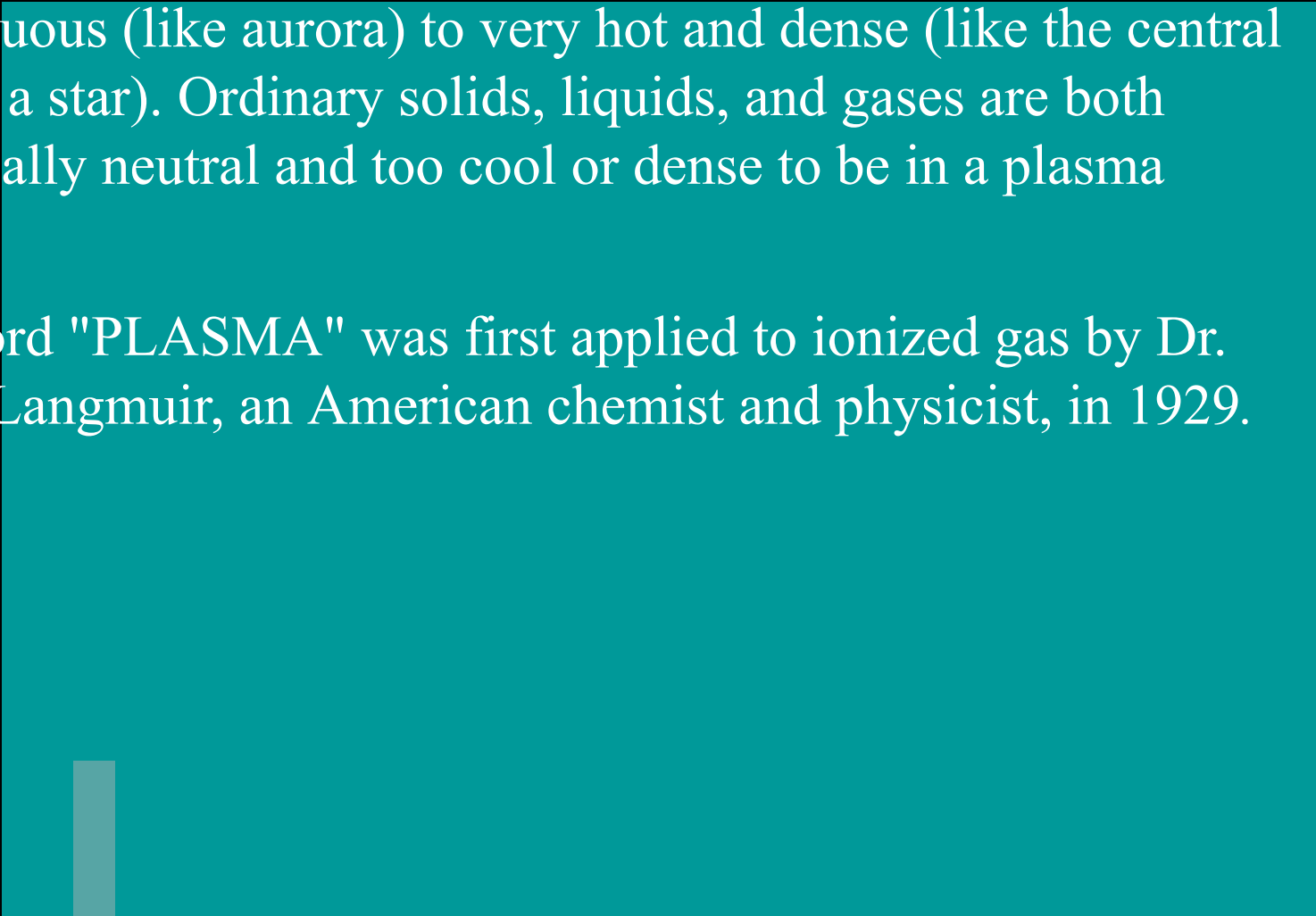
On earth we live upon an island of "ordinary" matter. The different states of matter generally found on earth are solid, liquid, and gas. We have learned to work, play, and rest using these familiar states of matter. Sir William Crookes, an English physicist, identified a fourth state of matter, now called plasma, in 1879.

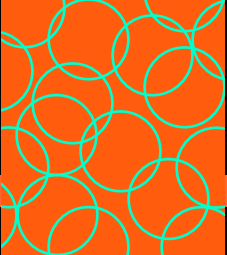


Plasma temperatures and densities range from relatively cool and tenuous (like aurora) to very hot and dense (like the central core of a star). Ordinary solids, liquids, and gases are both electrically neutral and too cool or dense to be in a plasma state.

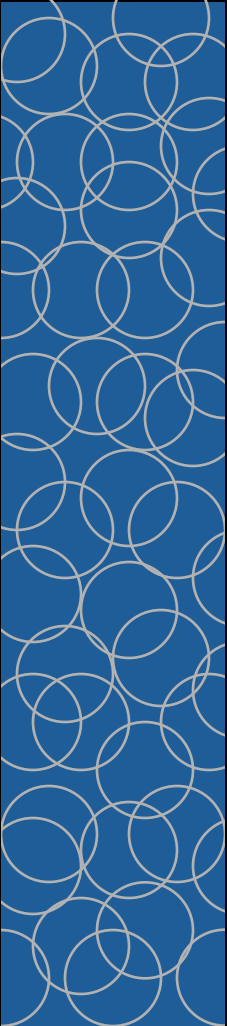


The word "PLASMA" was first applied to ionized gas by Dr. Irving Langmuir, an American chemist and physicist, in 1929.





States of Matter



Plasma

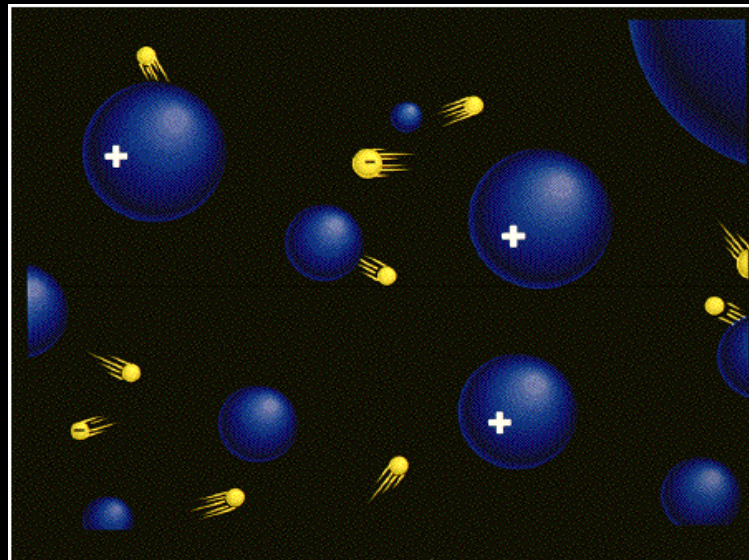
- A plasma is an ionized gas.
- A plasma is a very good conductor of electricity and is affected by magnetic fields.
- Plasma, like gases have an indefinite shape and an indefinite volume.

States of Matter

Plasma

Particles

The negatively charged electrons (yellow) are freely streaming through the positively charged ions (blue).



*Star formation in the
Eagle Nebula*

*Space Telescope Science
Institute, NASA*

(below)



(Above)

*X-ray view of Sun
from Yohkoh, ISAS
and NASA*

Some places where plasmas are found...

1. flames





2. Lightning

3. Aurora (Northern Lights)





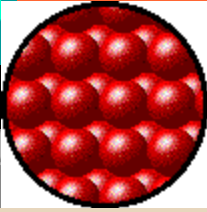
The Sun is an example of a star in its plasma state



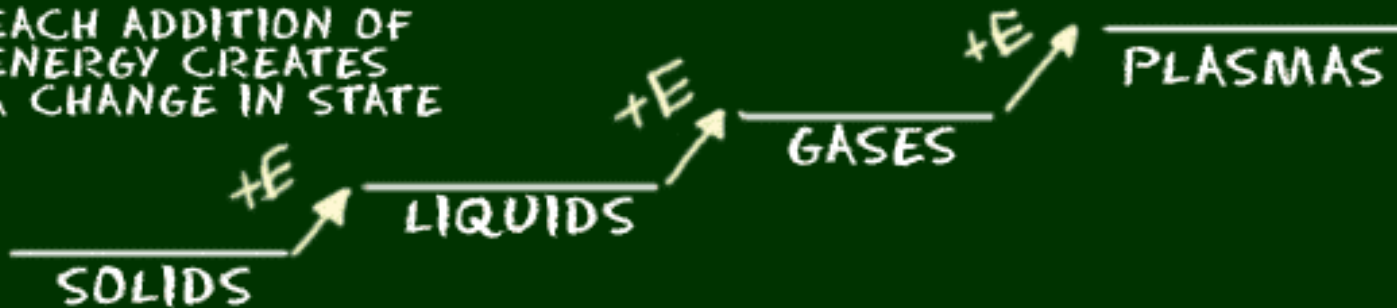


SUMMARY

STATES OF MATTER



EACH ADDITION OF
ENERGY CREATES
A CHANGE IN STATE



SOLID

Tightly packed, in a regular pattern
Vibrate, but do not move from place to place

LIQUID

Close together with no regular arrangement.
Vibrate, move about, and slide past each other

GAS

Well separated with no regular arrangement.
Vibrate and move freely at high speeds

PLASMA

Has no definite volume or shape and is composed of electrical charged particles

EXAMPLES:

Computer chips and
integrated circuits

Printing on plastic food
containers

Computer hard drives

Energy-efficient window
coatings

Electronics

- High-efficiency window coatings

Machine tools

- Safe drinking water

Medical implants and
prosthetics

- Voice and data communications
components

Audio and video tapes

- Anti-scratch and anti-glare

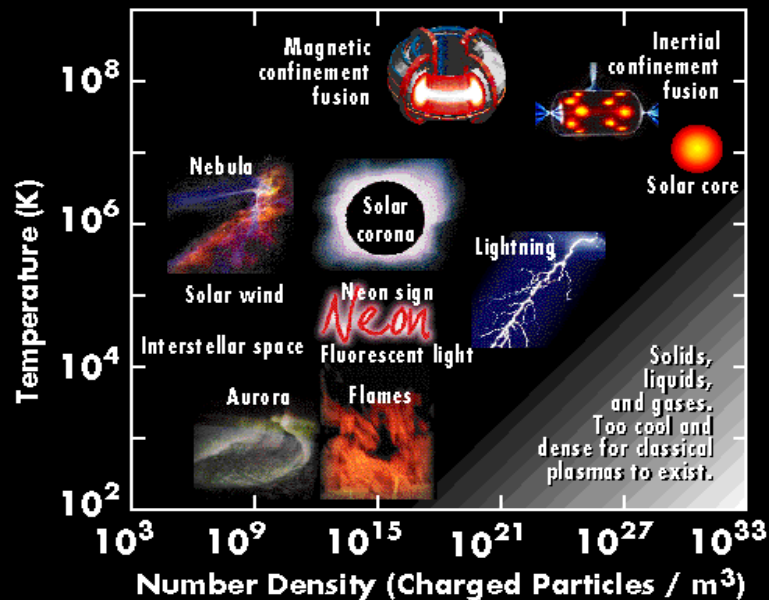
Aircraft and automobile
engine parts

- coatings on eyeglasses and other
optics

States of Matter

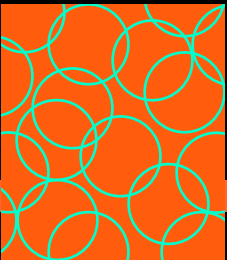
Plasma

Examples

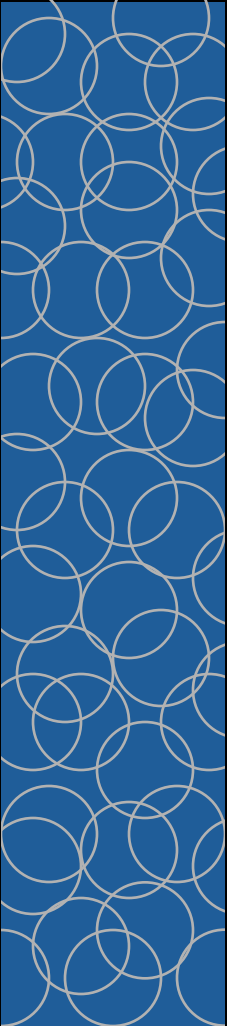


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Images courtesy of DOE fusion labs, NASA, and Steve Albers.



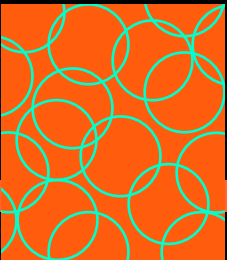


States of Matter

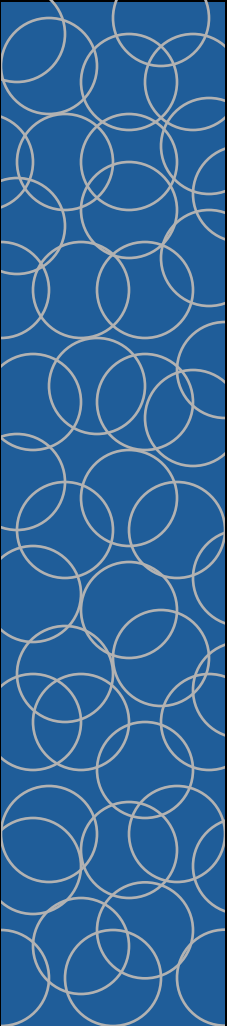


Microscopic Explanation for Properties of Solids

- Solids have a definite shape and a definite volume because the particles are locked into place
- Solids are not easily compressible because there is little free space between particles
- Solids do not flow easily because the particles cannot move/slide past one another

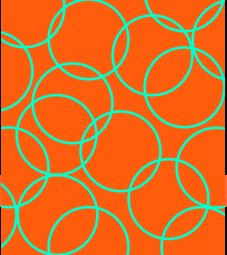


States of Matter

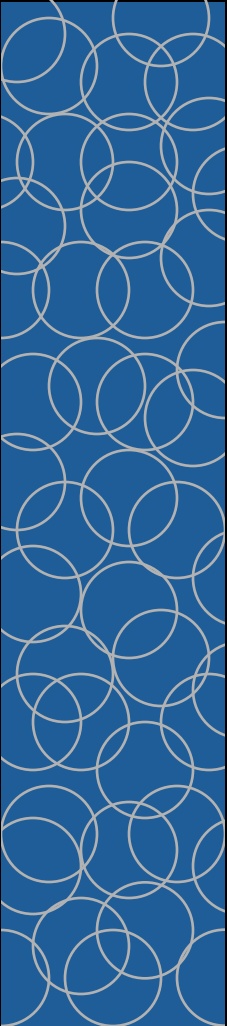


Microscopic Explanation for Properties of Liquids

- Liquids have an indefinite shape because the particles can slide past one another.
- Liquids are not easily compressible and have a definite volume because there is little free space between particles.
- Liquids flow easily because the particles can move/slide past one another.

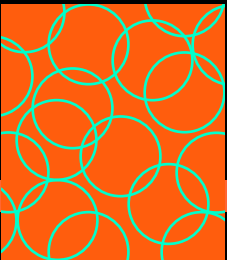


States of Matter

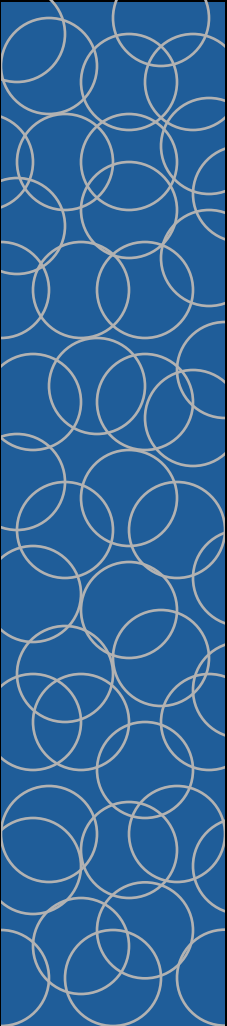


Microscopic Explanation for Properties of Gases

- Gases have an indefinite shape and an indefinite volume because the particles can move past one another.
- Gases are easily compressible because there is a great deal of free space between particles.
- Gases flow very easily because the particles randomly move past one another.
- Collisions between molecules and with the sides of a container are elastic (energy is conserved)



States of Matter



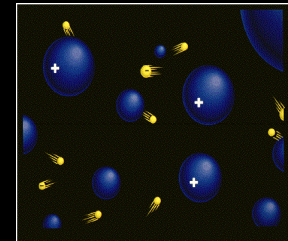
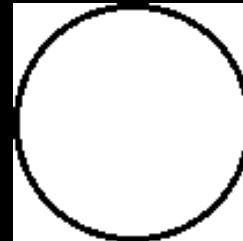
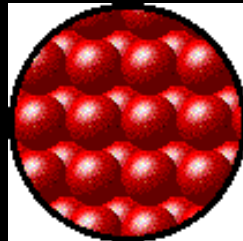
Microscopic Explanation for Properties of Plasmas

- Plasmas have an indefinite shape and an indefinite volume because the particles can move past one another.
- Plasmas are easily compressible because there is a great deal of free space between particles.
- Plasmas are good conductors of electricity and are affected by magnetic fields because they are composed of ions (negatively charged electrons and positively charged nuclei).

States of Matter

The Four States of Matter

The Classification and Properties of Matter Depend Upon Microscopic Structure



- Particle arrangement
- Particle energy
- Particle to particle distance