



PHASES OF MATTER

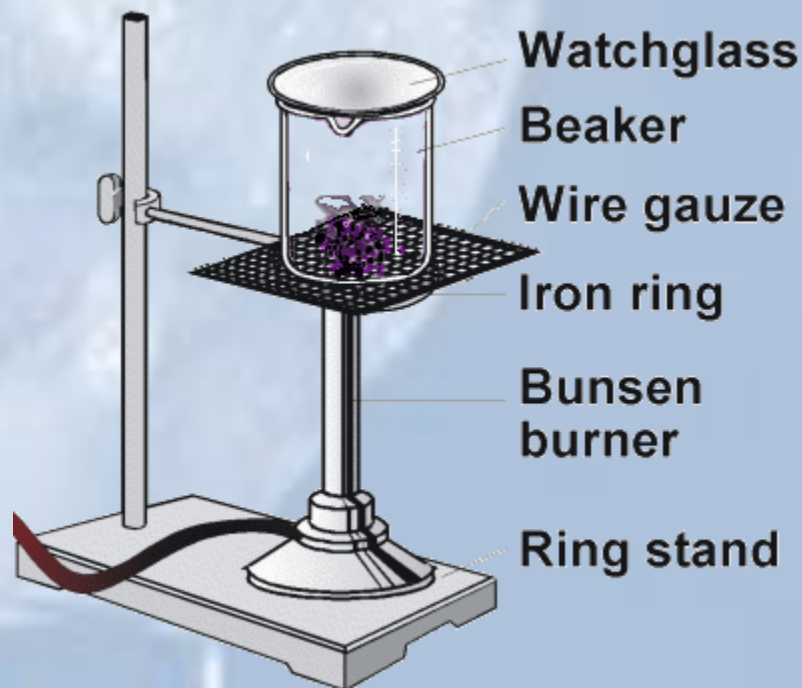
Solid, Liquid, and Gas

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GASES: EXPERIMENT 1

Volume of a gas

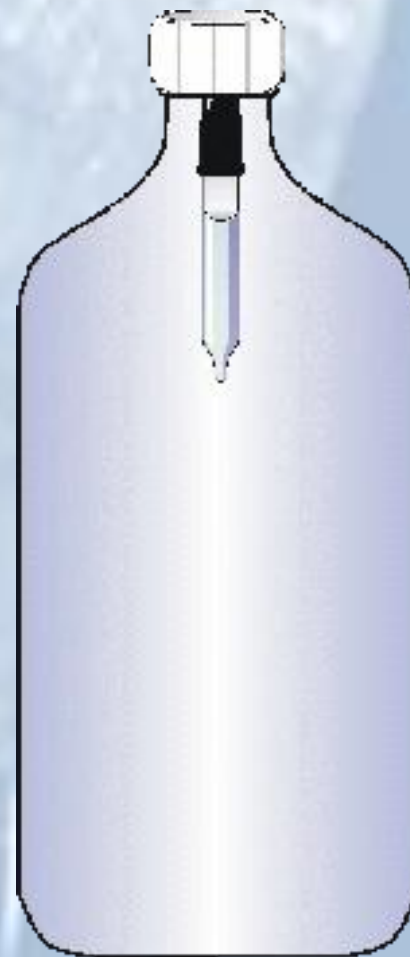
- Solid iodine sublimates (turns directly from a solid to a gas) when you heat it.
- Place a few crystals of iodine in a small beaker and cover it with a watchglass.
- Place the beaker on a wire gauze on a ringstand and heat it with a Bunsen burner.
- Note what happens to the color overtime.
- Note how much of the space in the beaker is occupied by the gas.



GASES: EXPERIMENT 2

Effect of pressure on the volume of a gas

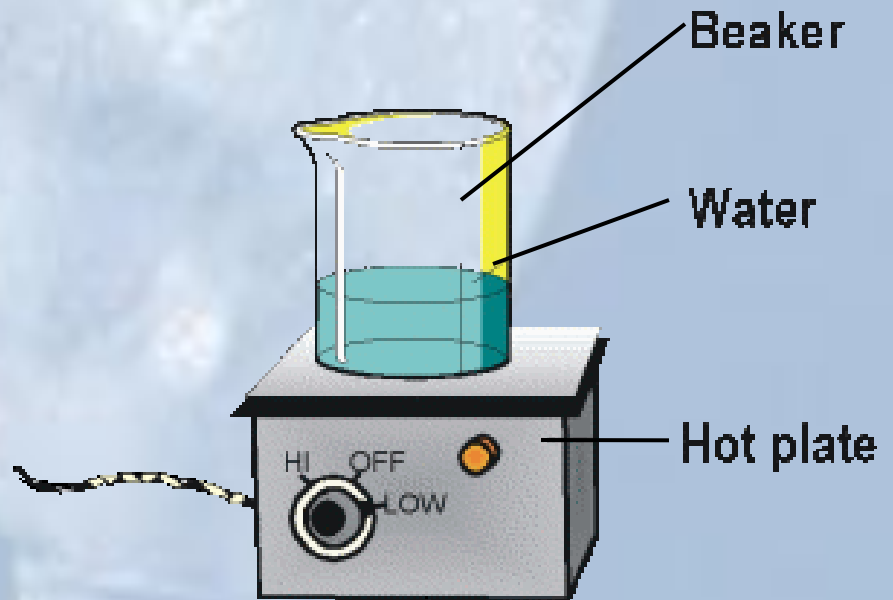
- Squeeze the container (soda bottle) in which a floating Cartesian diver (medicine dropper) is located.
- Note what happens to the diver.
- Note what happens to the size of the air bubble in the dropper when the container is squeezed.



LIQUIDS: EXPERIMENT 3

Diffusion in water

- Put a beaker of water on a hotplate set on low.
- Allow the water to sit until it is still.
- Put a drop of food coloring in the water and wait five minutes.
- Note what the food coloring does.



LIQUIDS: EXPERIMENT 4

Shape and volume

- Pour 10 mL of water into a 10 mL graduate.
- Transfer the water to a 50 mL graduate.
- Transfer the water to a 100 mL graduate.
- Note what happens to its shape and volume.



LIQUIDS: EXPERIMENT 5

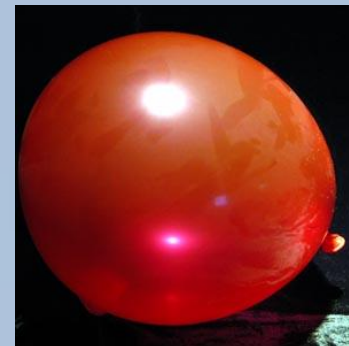
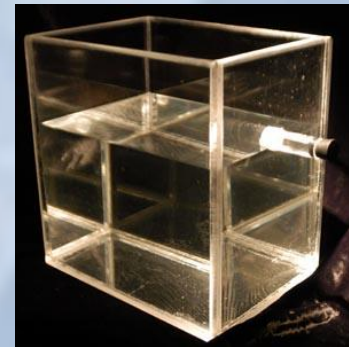
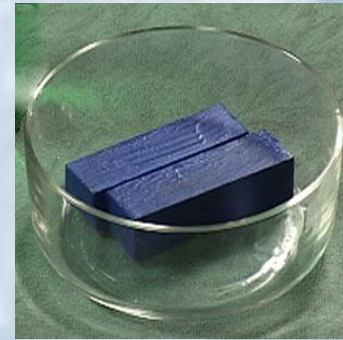
- Pour water into an apparatus shaped like the one pictured to the right.
 - Note how the shape of the water conforms to the container.
- Tilt the apparatus back and forth.
 - Note how the water level changes.



DEFINING SOLID, LIQUID, AND GAS



- Solid - has a definite shape and volume (*ie.* Shape and volume are not determined by the container)
- Liquid - has a definite volume, but no definite shape (*ie.* Takes the shape of its container)
- Gas - has no definite shape and no definite volume
 - Takes the shape of its container
 - Spreads out to fill its container



KINETIC MOLECULAR THEORY

The differences between the phases can be explained by the *Kinetic Molecular Theory*.

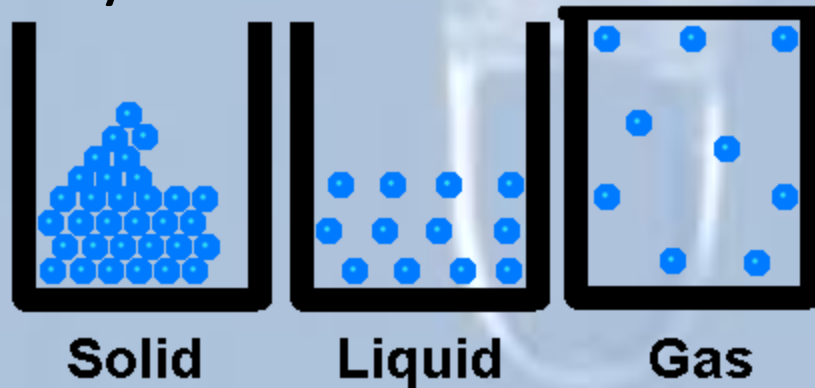
According to the *Kinetic Molecular Theory*:

- Matter is composed of particles that are in constant motion (kinetic energy).
- There are forces of attraction between particles that depend on the distance between the particles.
 - The further apart the particles are, the smaller the forces of attraction between them are.
- The higher the temperature (average kinetic energy) is, the faster the particles move.



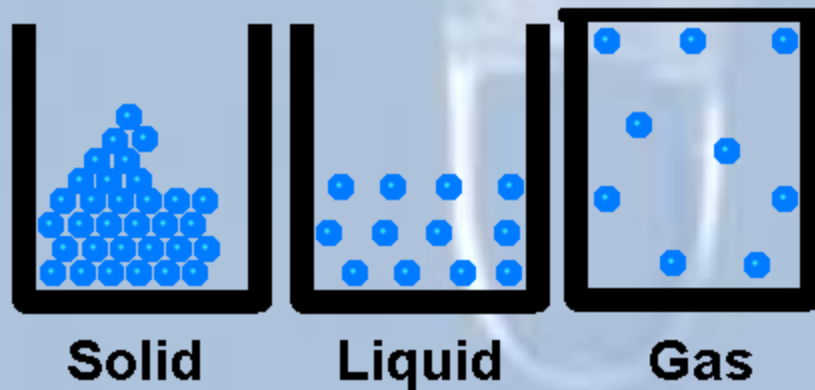
KINETIC MOLECULAR THEORY EXPLAINS SOLIDS

- **Solid** - the forces of attraction between particles are larger than in other phases.
- Particles are held in fixed positions.
- Particles vibrate back and forth.
- Particles are relatively close together.
- Therefore the shape and volume are not determined by the container.



KINETIC MOLECULAR THEORY EXPLAINS LIQUIDS

- **Liquids** - the forces of attraction between particles are moderate compared to other phases.
- Particles can move from place to place but cannot separate from each other and move independently.
- Particles roll and slide over each other.
- Particles are pulled downhill by gravity causing the liquid to seek its own level.
- Therefore the shape is determined by the container but the volume is not.



KINETIC MOLECULAR THEORY EXPLAINS GASES

- **Gases** - the forces of attraction between particles are weaker than in other phases
- Particles can move from place to place independently of each other because they do NOT attract or repel each other.
- Particles are relatively far apart. The volume of the particles is small compared to the space between them.
- Particles tend to spread out to fill their container.
- Therefore both the shape and volume are determined by the container.

