What Are the States of Matter?

Chapter 10 Lesson 2

ByDesign Science, Level 4
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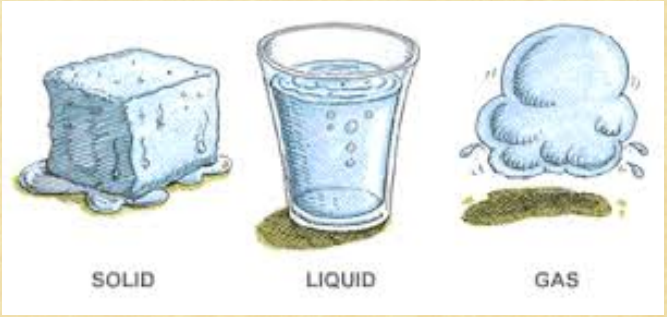
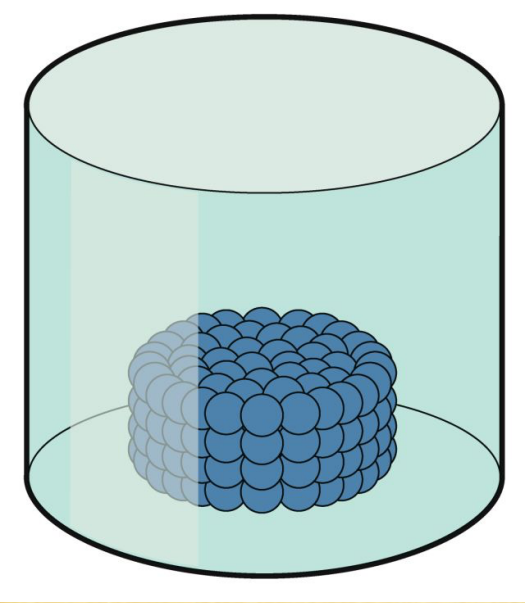
Solid, Liquid, or Gas

- An important property of matter is its state at room temperature.



- Solid, liquid, and gas are three states of matter that are common on Earth.
- The fact that matter can exist in different forms illustrates the design and care by which God creates.
- You can tell if matter is a solid, liquid, or gas by analyzing its shape and volume.

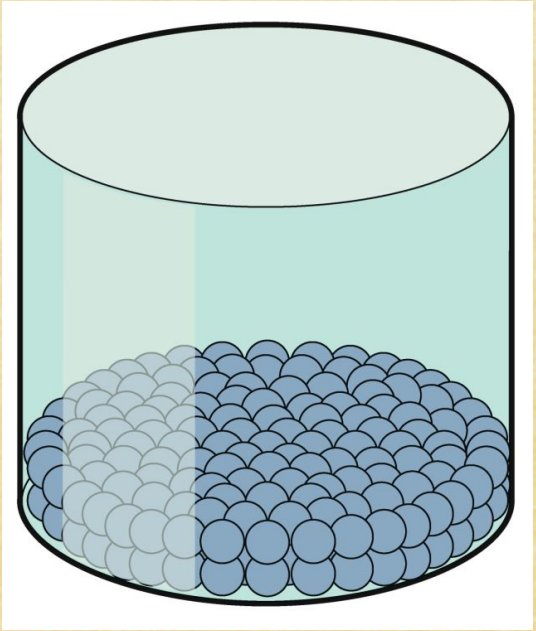
Solid, Liquid, or Gas



- A *solid* has a definite volume and a definite shape.
- An ice cube is a solid.
- Look around and see if you can find other examples of solids.

Solid, Liquid, or Gas

- A *liquid* has a definite volume, but it has an indefinite shape.
- A liquid can change shape if you place it into a different container.
- Water is a liquid at room temperature.

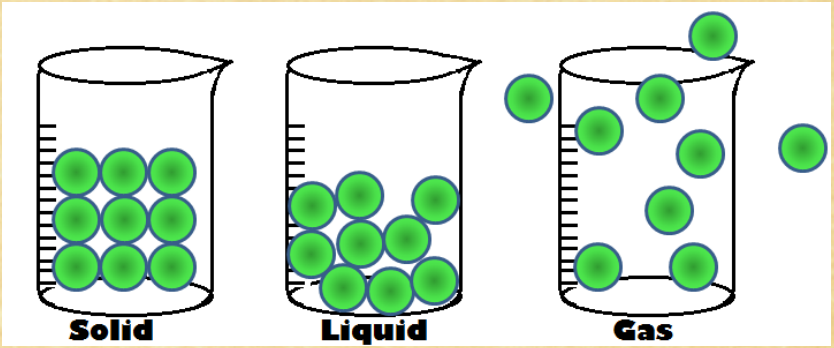


Solid, Liquid, or Gas

- If you pour some water into a glass, it takes the shape of the glass.
- Suppose you pour the same water into a vase.
- Its volume is the same, but its shape changes.

Solid, Liquid, or Gas

- A *gas* has both an indefinite volume and an indefinite shape.
- A gas takes the shape of its container.
- Air is made up of different gases.

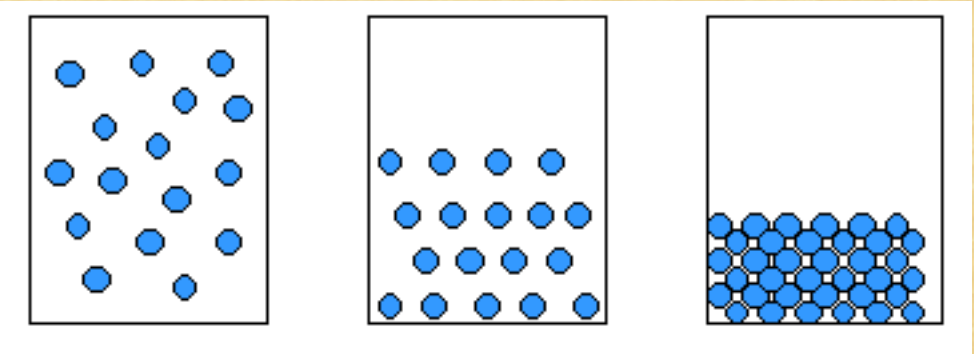


Solid, Liquid, or Gas

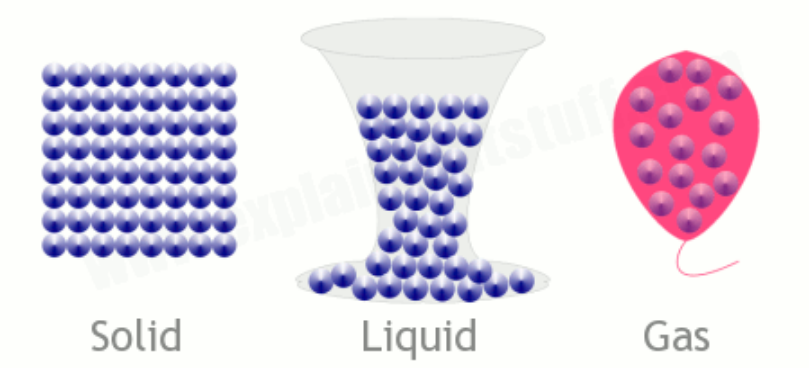
- If you blow up a balloon, the air takes the shape of the balloon.
- When you let the air out of a balloon, the gases in the air spread all around.
- A gas has an indefinite shape and always spreads out to fill any available volume.

Solid, Liquid, or Gas

- You have learned that all matter is made of tiny particles called atoms.
- The atoms in matter have different arrangements in each different state of matter.
- Atoms also move differently in the different states of matter.



Solid, Liquid, or Gas

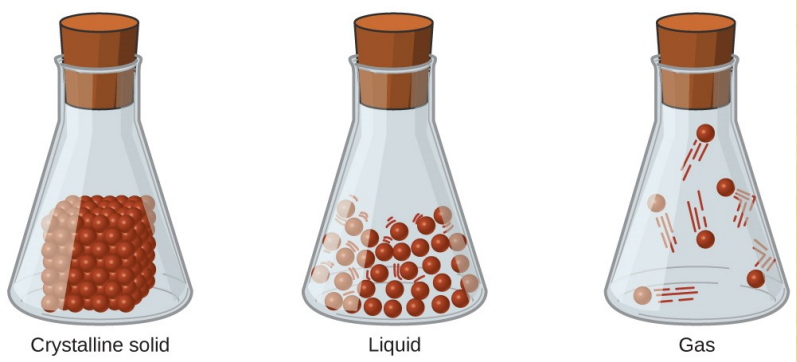


- A solid keeps a certain shape because its atoms are packed closely together.

- The atoms in matter are always moving.
- In a solid, the atoms vibrate, or move back and forth.
- They do not exchange places with one another.

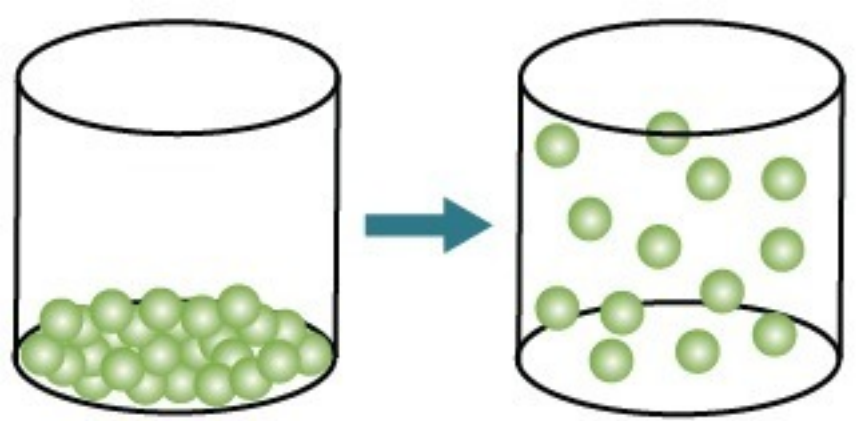
Solid, Liquid, or Gas

- Atoms in a liquid are farther apart than those in a solid, and they vibrate faster.



- The atoms are not packed together, so they can slide around one another.
- Therefore you can pour a liquid and why a liquid can change its shape.

Solid, Liquid, or Gas

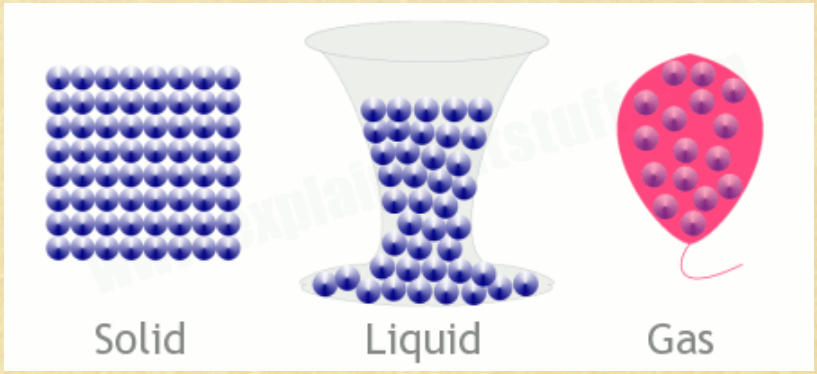


- The atoms in a gas are not packed together strongly.
- They are farther apart than those in a liquid.

- Therefore it is easier to move through the air than to push through the water in a swimming pool.

Solid, Liquid, or Gas

- Gas particles move around much faster than atoms of solids or liquids.

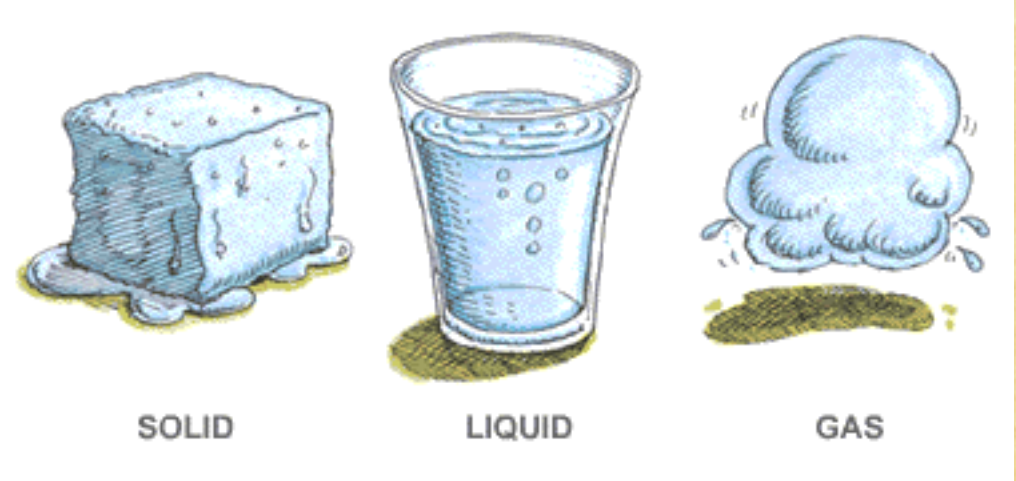


- They move around freely, and bounce off one another.
- So, they can spread out and fill any available space.

Solid, Liquid, or Gas

Changes of State

- Many types of matter can change from one state to another.
- Matter looks different when it changes state, but it is still the same kind of matter.



Changes of State

- Think of ice melting.
- Ice is water in its solid state.
- When ice is changing to water, it melts.

- Melting happens when matter is heated and changes from a solid to a liquid.

Changes of State

- The temperature at which a substance melts is called its melting point.
- The melting point of ice is 0°C (32°F).

Changes of State

Solid	Melting Point
Aspirin	136°C (277°F)
Beeswax	64°C (147°F)
Gold	1064°C (1947°F)
Ice (solid water)	0°C (32°F)
Mercury	-39°C (-38°F)
Salt	801°C (1474°F)
Sugar	186°C (367°F)

Changes of State

- Think about a pot of water on the stove. When the water becomes hot enough, it boils.
- Boiling happens when matter is heated and changes from a liquid to a gas.

- The **boiling point** is the temperature at which a liquid boils and changes to a gas.
- The boiling point of water is 100°C (212°F) at sea level.

Changes of State

- You have probably seen a puddle that disappeared over time.

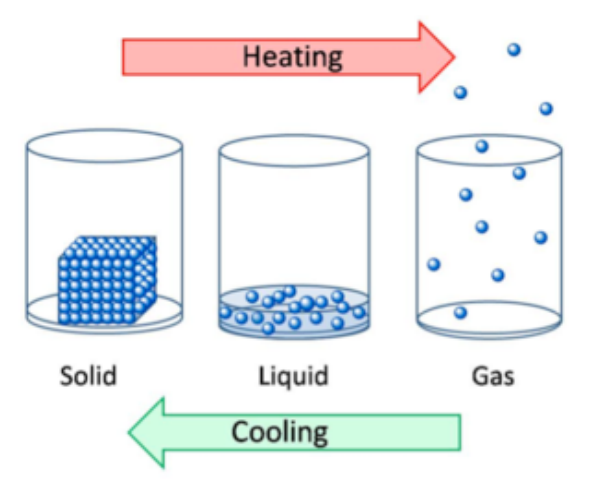
- Some water in the puddle changed to a gas without boiling.
- Matter **evaporates** when it changes from a liquid to a gas.
- Water in the form of a gas is called *water vapor*.

Changes of State

- Cooling air causes water vapor to change to a liquid.
- Matter **condenses** when it changes from a gas to a liquid.

- You may have seen condensation on a bathroom mirror or windowpane after taking a hot shower.
- This is also what causes dew on surfaces outside and fog.

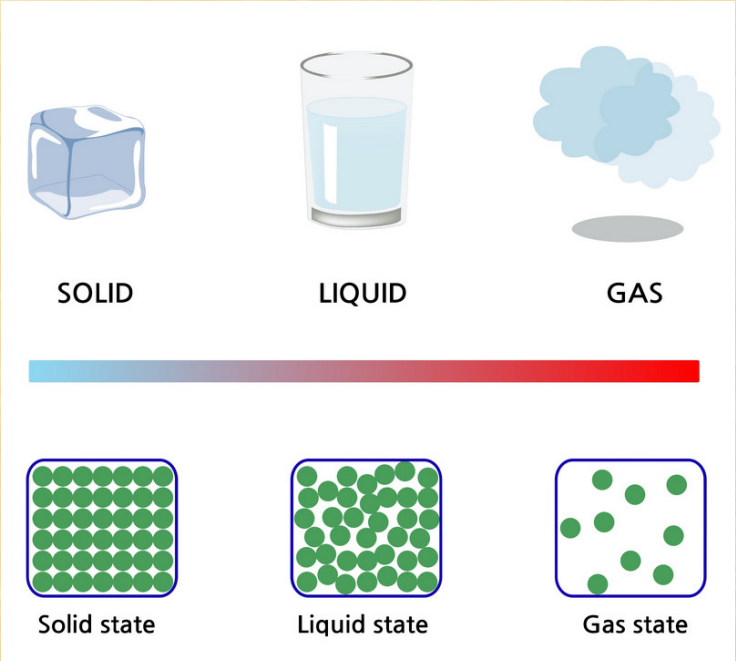
Heating Matter



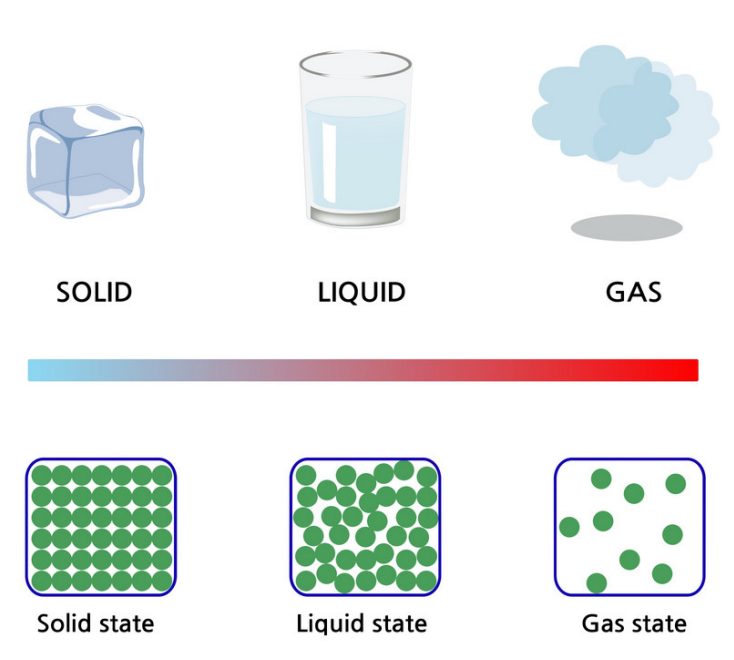
- Recall that thermal energy is the kinetic energy that moves the atoms that make up matter.
- Heat refers to the movement of this energy from one object to another.
- When thermal energy is added to a solid, the atoms begin to move faster.

Heating Matter

- Some atoms begin to break off the solid.
- They can now move around one another.
- They become liquid.



Heating Matter



- If you continue adding thermal energy to a liquid, the atoms of the liquid move faster and move farther apart.
- The temperatures rises.
- The atoms begin to break away from the liquid's surface.

Heating Matter

- Finally, the atoms move so fast that atoms form bubbles of gas within the liquid.
- They rise and escape into the air.
- The liquid becomes a gas.