TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

What are solids, liquids, and gases?

- Materials can be classified as solids, liquids, or gases, based on whether their shapes and volumes are definite or variable.
- A material's shape and volume are clues to how the particles within the material are arranged.
- States of matter depend on the temperature of matter.
  - At extremely high temperatures, such as those found on the sun or other stars, matter exists in a fourth state known as plasma.
  - At extremely low temperatures, close to absolute zero, a fifth state of matter, called the Bose-Einstein condensate, can form.

(contd.)

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

Solids

- A **solid** has a definite shape and a definite volume.
- The particles that make up a solid are packed very closely together. Each particle is tightly fixed in one position and can only vibrate in place.
- In many solids, the particles form a regular, repeating pattern that creates crystals. Solids made up of crystals are called **crystalline solids.**
  - Salt, sugar, and snow are examples of crystalline solids. When a crystalline solid is heated, it melts at a distinct temperature.
- In **amorphous solids,** the particles are not arranged in a regular pattern.
  - Glass, plastics, and rubber are examples of amorphous solids. Amorphous solids do not melt at a distinct temperature.

(contd.)

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Liquids

- A **liquid** has a definite volume but no definite shape of its own. The shape of a liquid changes with the shape of its container.
- The particles in a liquid are packed almost as closely together as in a solid. However, the particles in a liquid can move around freely.
- Freely moving particles allow a liquid to flow from place to place. For this reason a liquid is a fluid, meaning a substance that flows.
- Surface tension is a characteristic property of liquids. **Surface tension** is an inward force between the molecules in a liquid that brings the molecules on the surface closer together.
- **Viscosity,** a liquid's resistance to flowing, is also a characteristic property of liquids. A liquid's viscosity depends on the size and shape of its particles and the attractions between the particles.
  - Liquids with high viscosity, such as honey, flow slowly.
  - Liquids with low viscosity, such as water and vinegar, flow quickly.

(contd.)

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

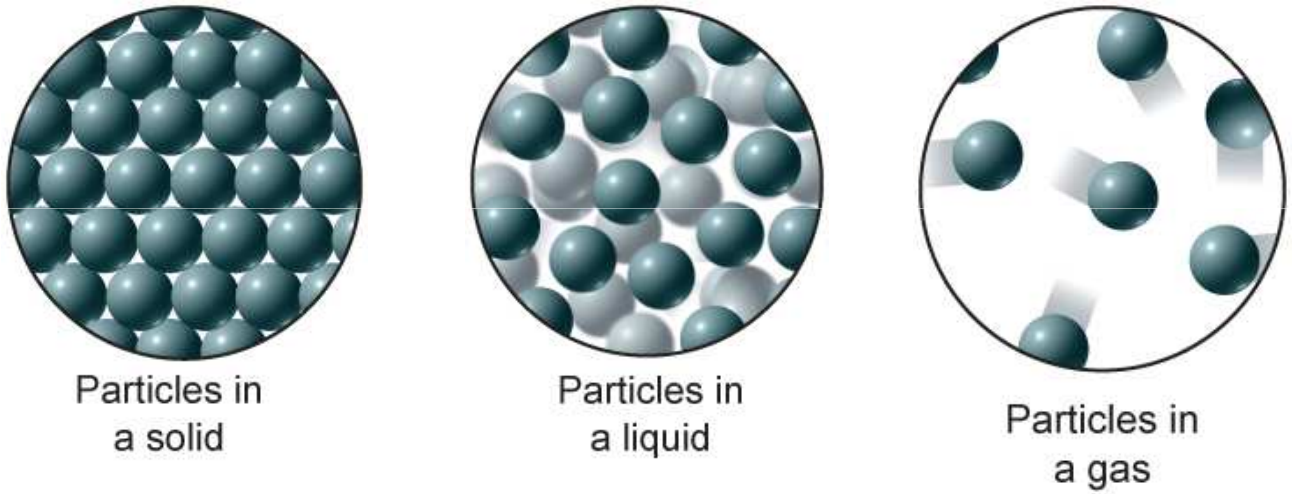
Gases

- A **gas** has neither a definite shape nor a definite volume.
- Like liquids, gases are fluids. The particles in a gas can move around one another freely.
  - If a gas is released in a closed container, the gas particles will move in all directions and spread apart as they fill the container.

(contd.)

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

The particles of a solid are closely packed in position and can only vibrate in place. The particles of a liquid and gas are free to move. A liquid has a definite volume but no definite shape, whereas a gas has neither a definite volume nor a definite shape.



SCIENCE notebook

1. Examine Differences *In the figure above, examine and describe differences in the strength of the attractive forces between the particles of a solid, a liquid, and a gas. How do these differences affect the ability of each state of matter to change its shape and volume?*

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

How does kinetic theory explain physical properties of solids, liquids, and gases?

- **Kinetic energy** is the energy an object has due to its motion. Any object that is moving has kinetic energy.
- The **kinetic theory of matter** says that all particles of matter are in constant motion.
  - The theory was developed in the mid-1800s to explain the physical properties of gases. It can also help to explain the properties of liquids and solids.

(contd.)

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Motion of Particles in Gases

- The particles in a gas are in constant, random motion.
  - Gas particles have no orderly arrangement. Each particle moves in a straight line until it collides with another particle or the container wall.
  - During collisions, particles lose or gain kinetic energy. However, the total kinetic energy of all the particles remains the same.
  - The constant motion of particles in a gas allows a gas to fill a container of any shape or size.
- Between collisions, the forces of attraction between the fast-moving particles in a gas are too weak to have an effect. Under ordinary conditions, scientists can ignore the forces of attraction in a gas.

(contd.)

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

Motion of Particles in Liquids

- The average speed of particles in a liquid is much slower than the average speed of particles in a gas.
- The particles of a liquid are more closely packed than those of a gas. Therefore, attractions between the particles in a liquid affect the movement of the particles.
- In a liquid, there is a tug-of-war between the constant motion of particles and the attractions between particles.
  - A liquid takes the shape of its container because particles in a liquid can flow to new locations.
  - The volume of a liquid is constant because the forces of attraction keep the particles close together.

(contd.)

TEKS 6A: Examine differences in ***physical properties of solids, liquids, and gases*** as explained by the ***arrangement and motion of atoms, ions, or molecules*** of the substances ***and the strength of the forces of attraction between those particles.***

Motion of Particles in Solids

- Particles in a solid have fixed locations in a volume that does not change.
  - Solids have a definite volume and shape because particles in a solid vibrate around fixed locations.
  - Strong attractions between the particles in a solid restrict their motion, keeping them in place.

2. Examine Differences *How does the kinetic theory of matter explain differences in the physical properties of solids, liquids, and gases? Examine both the arrangement of the particles in each state of matter and how the motion of the particles influences the strength of attraction between such particles.*