Essential Question: How do particles behave in the four states of matter?

Matter

- Atoms and molecules in matter are always in motion and are always bumping into one another.
- The speed and attraction of particles determines the state of matter.
- There are 3 familiar states of matter: solid, liquid, and gas
- A fourth state of matter called plasma only occurs at very high temperatures

Imagine dropping a marble into a bottle.

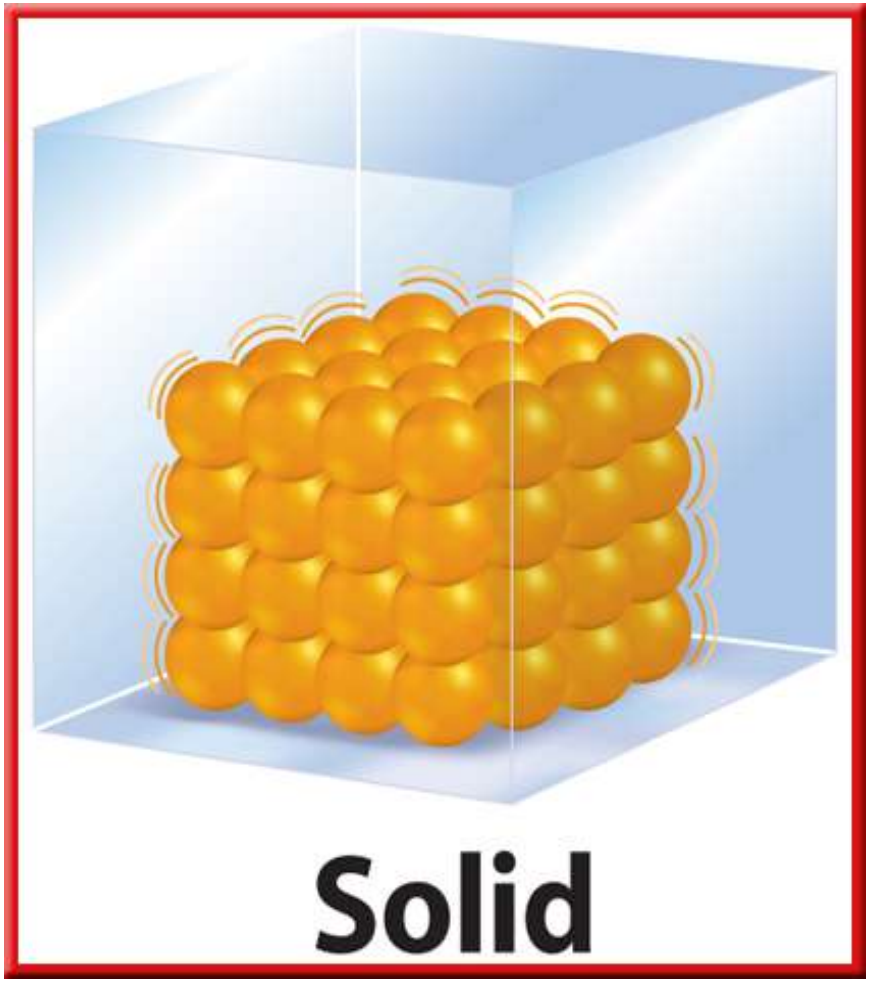
Would anything happen to the shape or size of the marble?

Would the shape or size of the marble change if you put it in a larger bottle?

Even in a bottle, a marble keeps its original shape and volume because it is a solid.

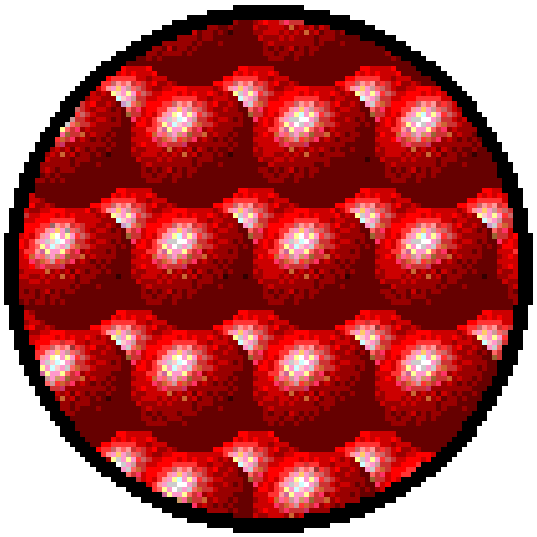
- A solid is the state of matter that has a definite shape and volume.

- The particles of a substance in a solid state are very close together and there is a strong attraction between them



Solid

- The particles in a solid move, but they do not move fast enough to overcome the attraction between them.
- Each particle vibrates in place. As shown in the diagram to the right
- Particles in a solid have LESS ENERGY than particles in other states
- http://www.middleschoolchemistry.com/multimedia/chapter1/lesson4#particles_of_a_solid

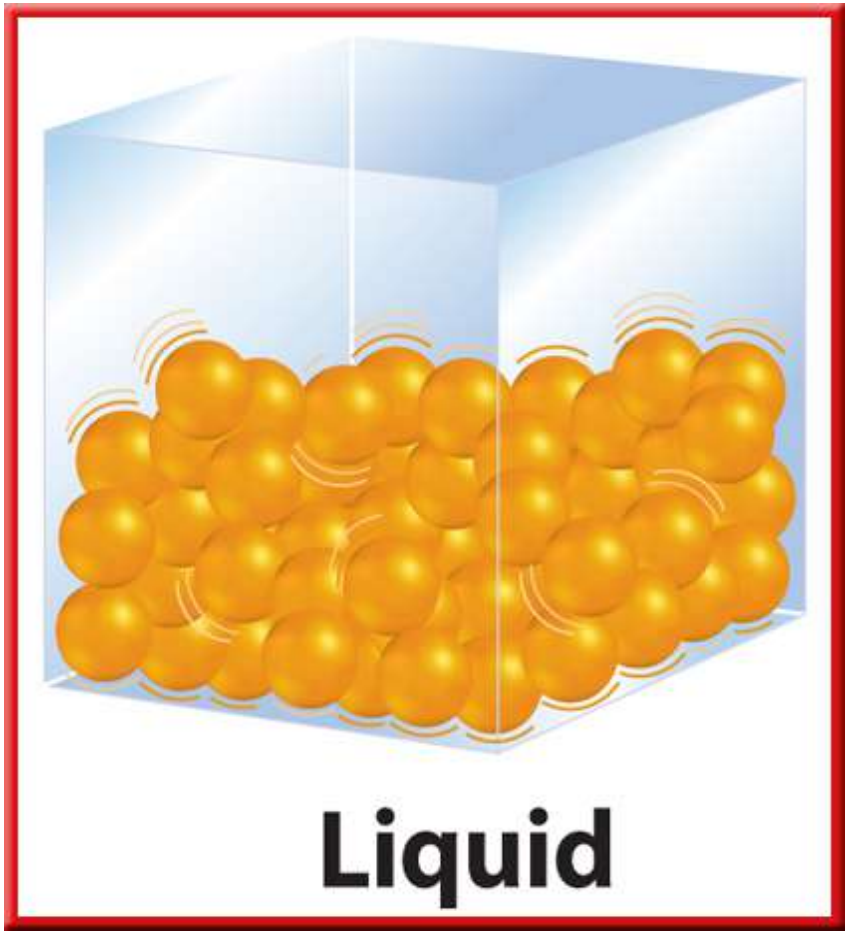


What do you think would change about soda if you poured it from a can into a glass?

Would the volume of the soda be different?

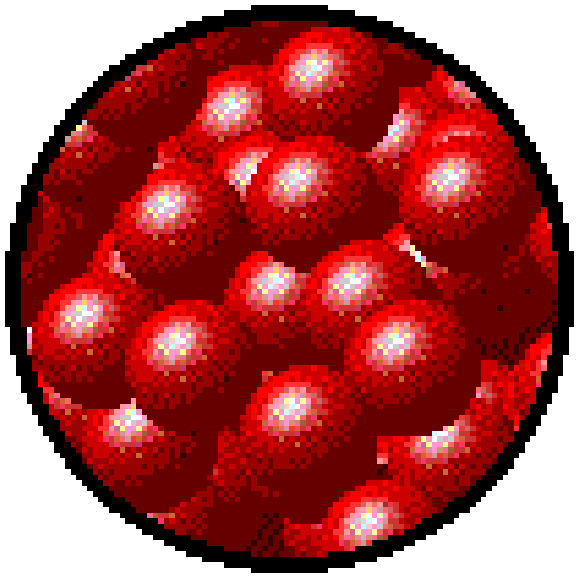
Would the taste of the soda change?

- Liquid is the state of matter that has a definite volume but no definite shape
- A liquid takes the shape of its container
- Although liquids change shape, the volume stays the same



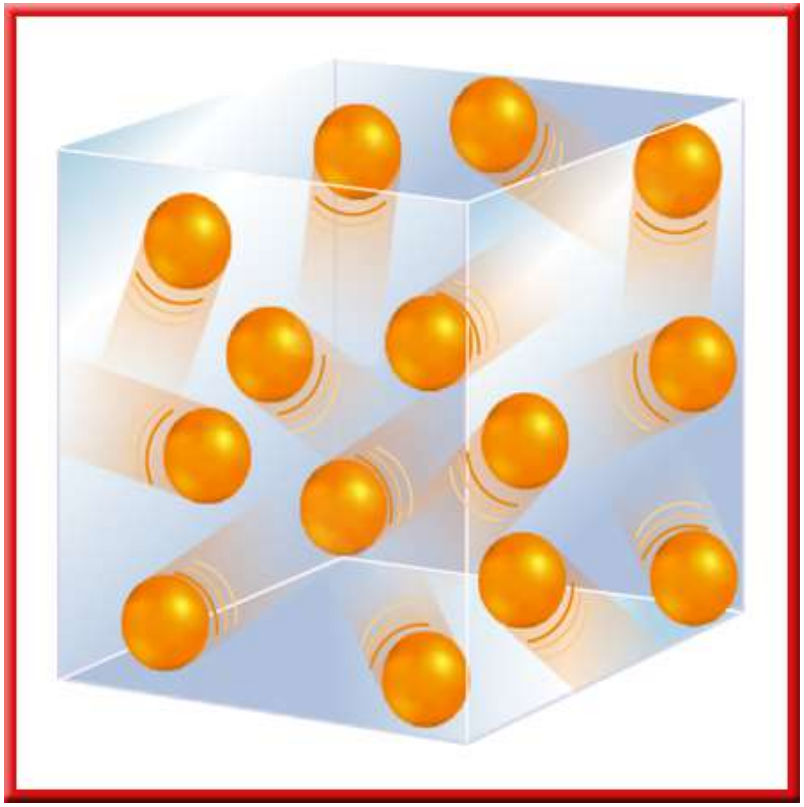
Liquid

- The particles are close together, but not attached. They slide past each other until the liquid takes the shape of its container
- Particles move independently; this causes flow.
- Particles in liquids have more energy than particles in solids
- Comparing solid and liquid movement of particles: http://www.middleschoolchemistry.com/multimedia/chapter1/lesson4#particles_of_a_solid



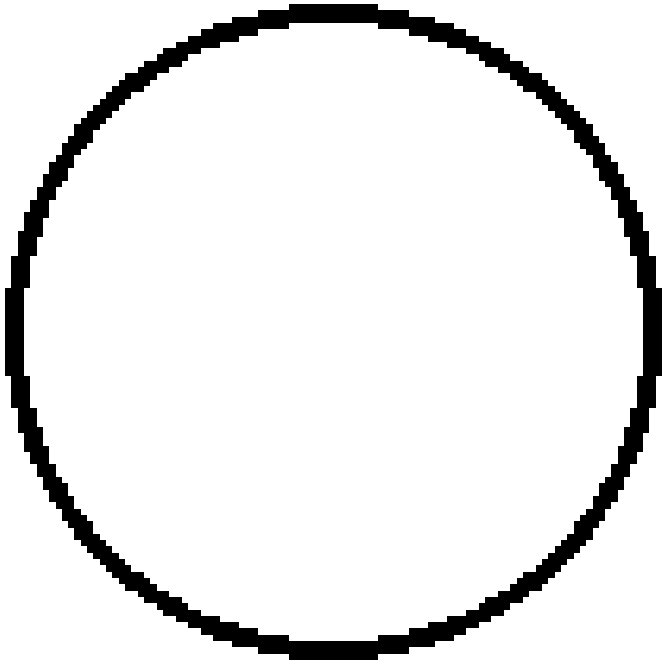
Gas

- A gas is the state of matter that has NO definite shape or volume.
- The particles of a gas move quickly and are far apart. So, they can break away completely from one another
- The amount of empty space between gas particles can change



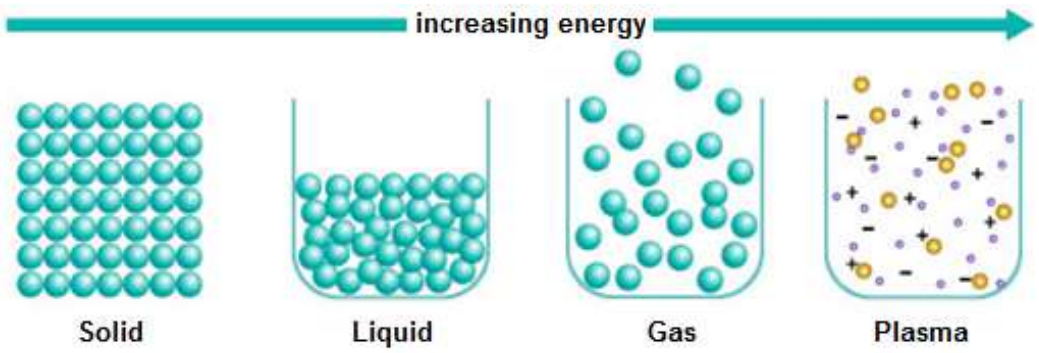
- The particles of a gas have less attraction between them than do particles of the same substance in the solid or liquid state.
- The particles of a Gas have more energy than the particles of a liquid or a solid

Gas



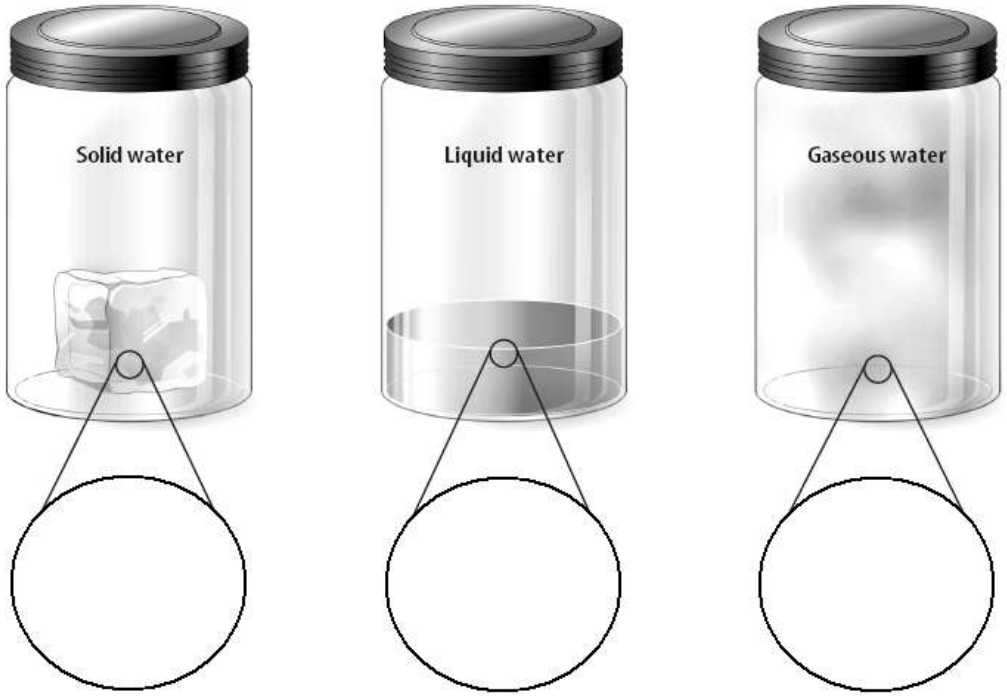
Plasma

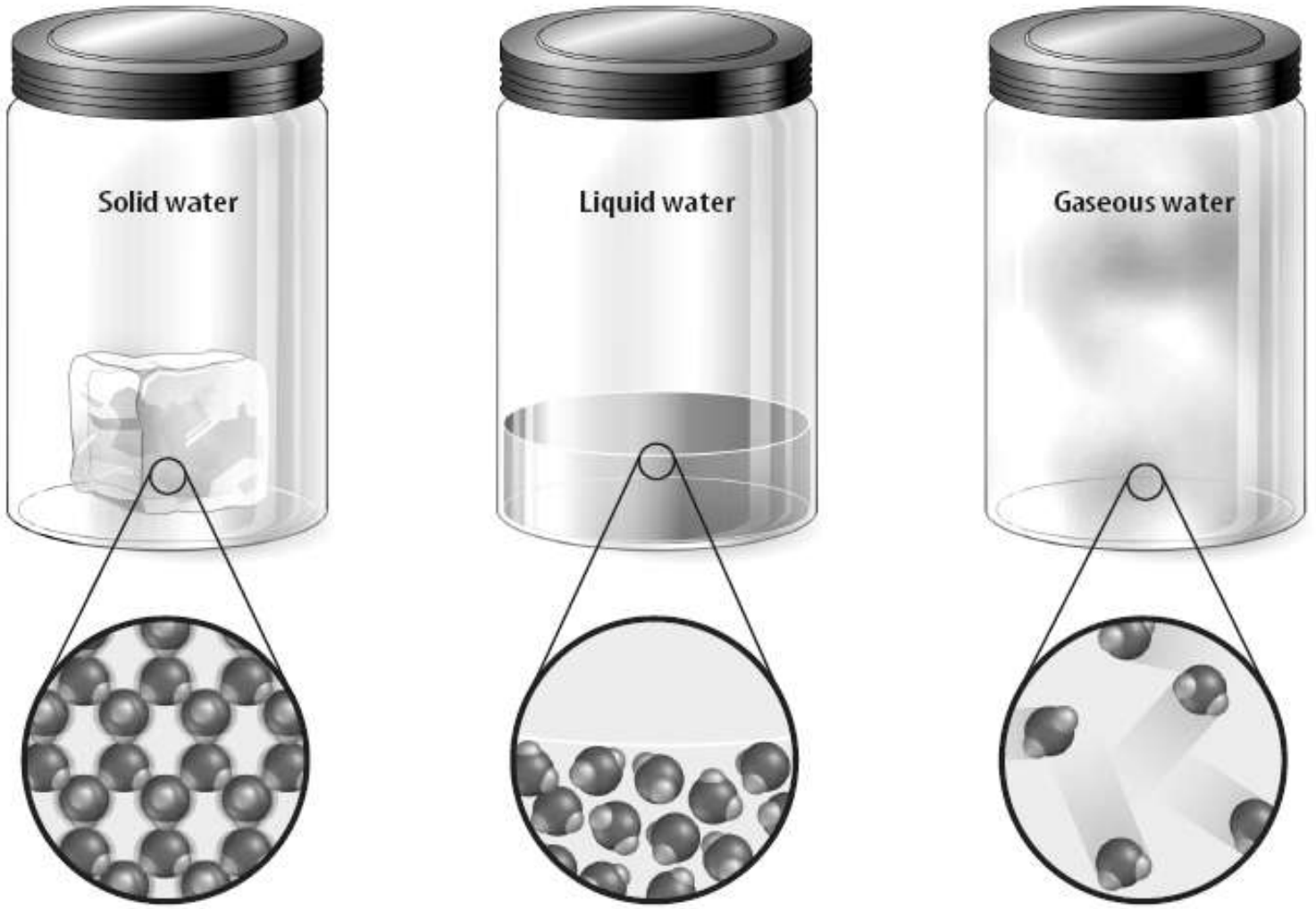
- Plasmas have the highest energy of the states of matter.
- They have no definite shape or volume
- Is a gas with an electrical charge
- Particles are very far apart and move EXTREMELY fast
- The energy not only exceeds the attractive forces among molecules but also exceeds the attractive forces that hold atoms together.
- As a result, molecules of plasma are broken down into a cloud of protons, neutrons, and electrons that all move and function together.
- Examples of Plasma: Lightning, fire, neon lights, Northern lights, stars



Distributed Summarizing

Illustrate the movement of particles in a solid, liquid, and gas in the diagram on your Notes Sheet.




Solid water
Liquid water
Gaseous water

It can be tricky to eat a frozen juice bar outside on a hot day.

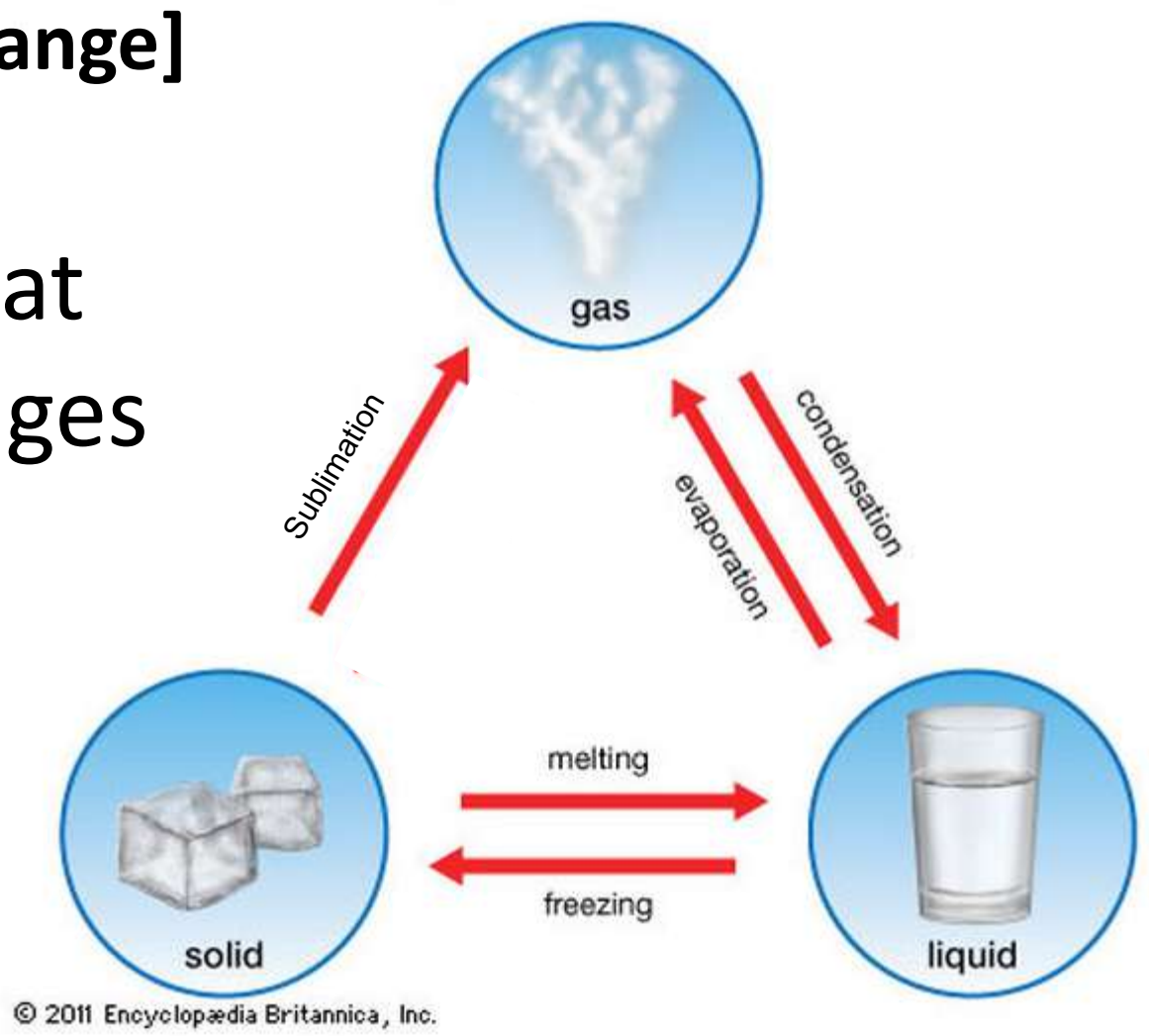
In just minutes, the juice bar will start to melt. Soon the solid juice bar becomes a liquid mess.

As the juice bar melts, it goes through a change of state.

Changes in State

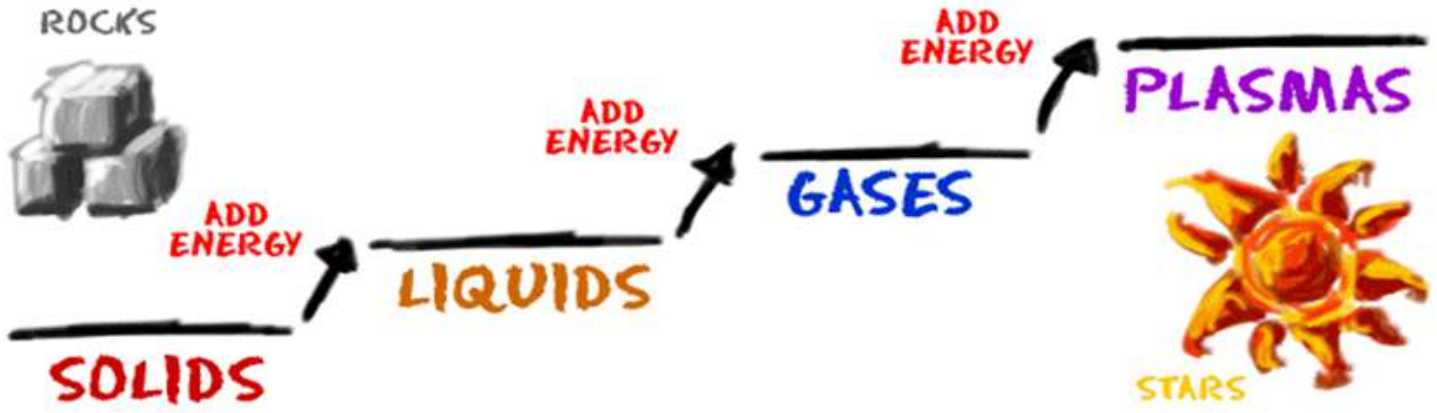
[Phase Change]

We will look at only four changes of state

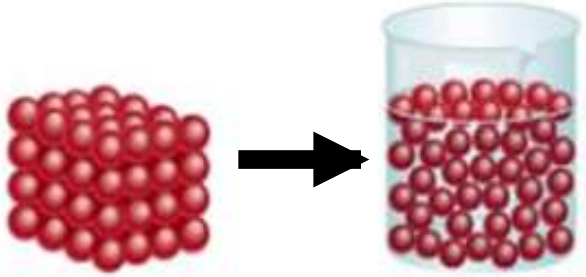


Energy and Changes in State

- As described earlier, particles in liquids have more energy than particles in solids, and particles in gases have more energy than particles in liquids
- Therefore, to change a substance from one state to another, you must add or remove energy



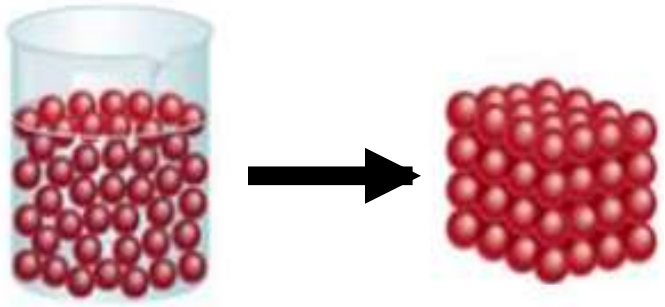
Melting: Solid to Liquid



- Adding energy to a solid increases the temperature of the solid. As the temperature increases, the particles of the solid move faster.
- When a certain temperature is reached, the solid will melt.
- The temperature at which a substance changes from a solid to a liquid is the melting point of the substance. Which type of property is melting point?

Physical Property of Matter

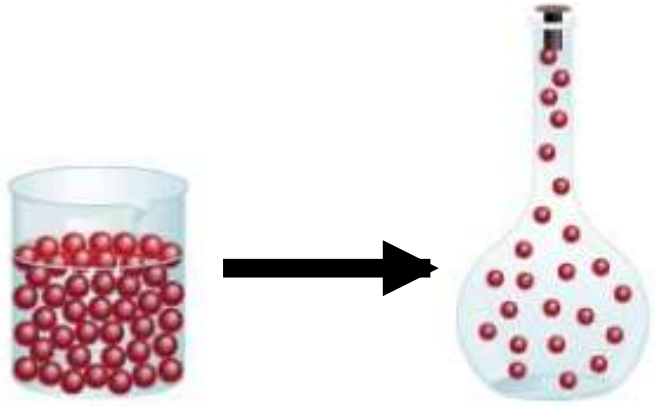
Freezing: Liquid to Solid



- Removing energy from a liquid (decreasing temperature) will cause the particles to slow down and begin locking into place

- When a certain temperature is reached, the liquid will freeze. Freezing is the reverse of melting; thus, freezing and melting occur at the same temperature (one adds energy and one removes energy)

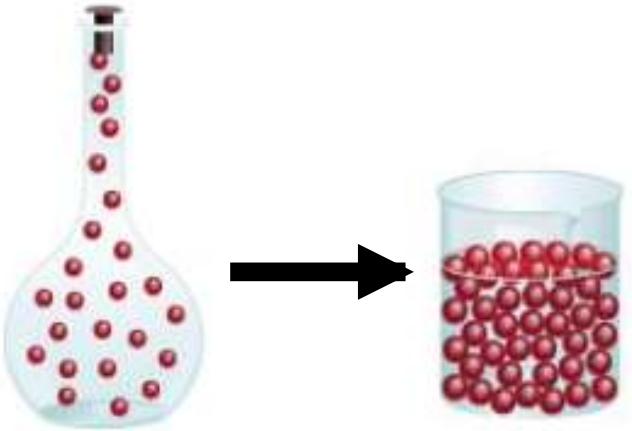
Boiling/Evaporating: Liquid to Gas



- As energy is added to a liquid (increasing temperature), particles throughout the liquid move faster

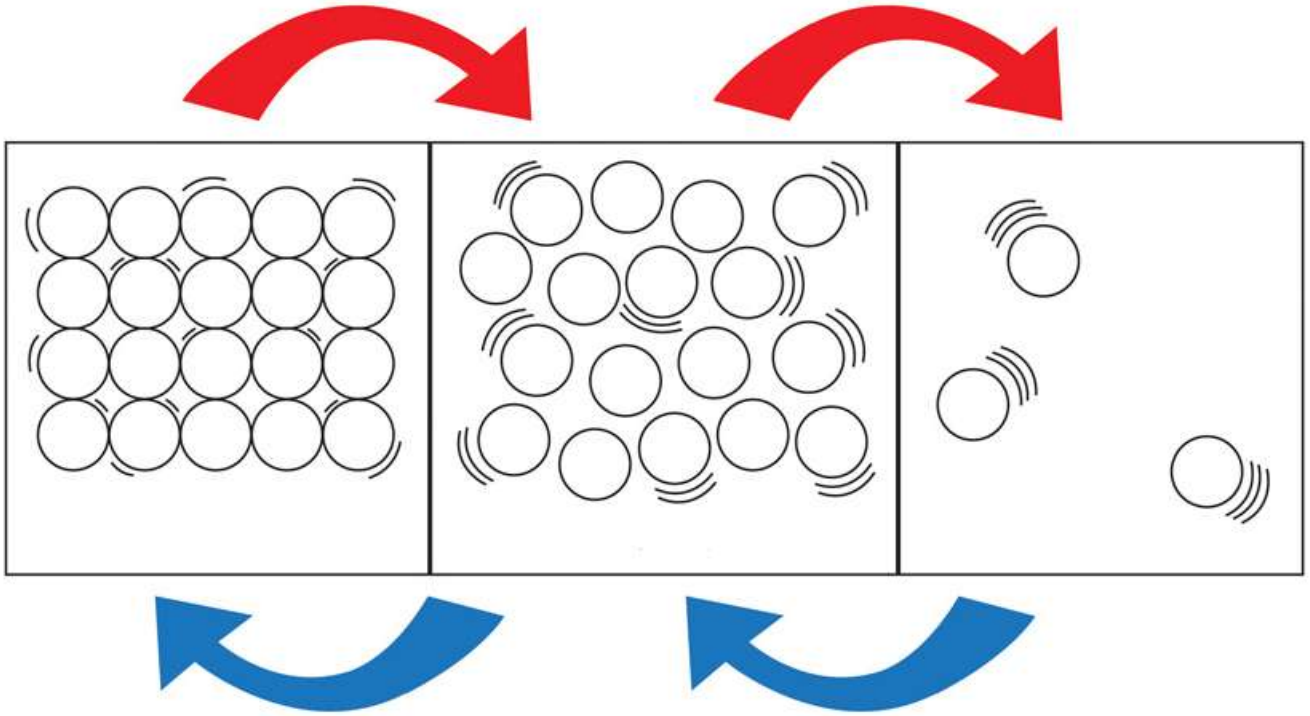
- When particles move fast enough to break away from other particles, they evaporate and become a gas

Condensing: Gas to Liquid

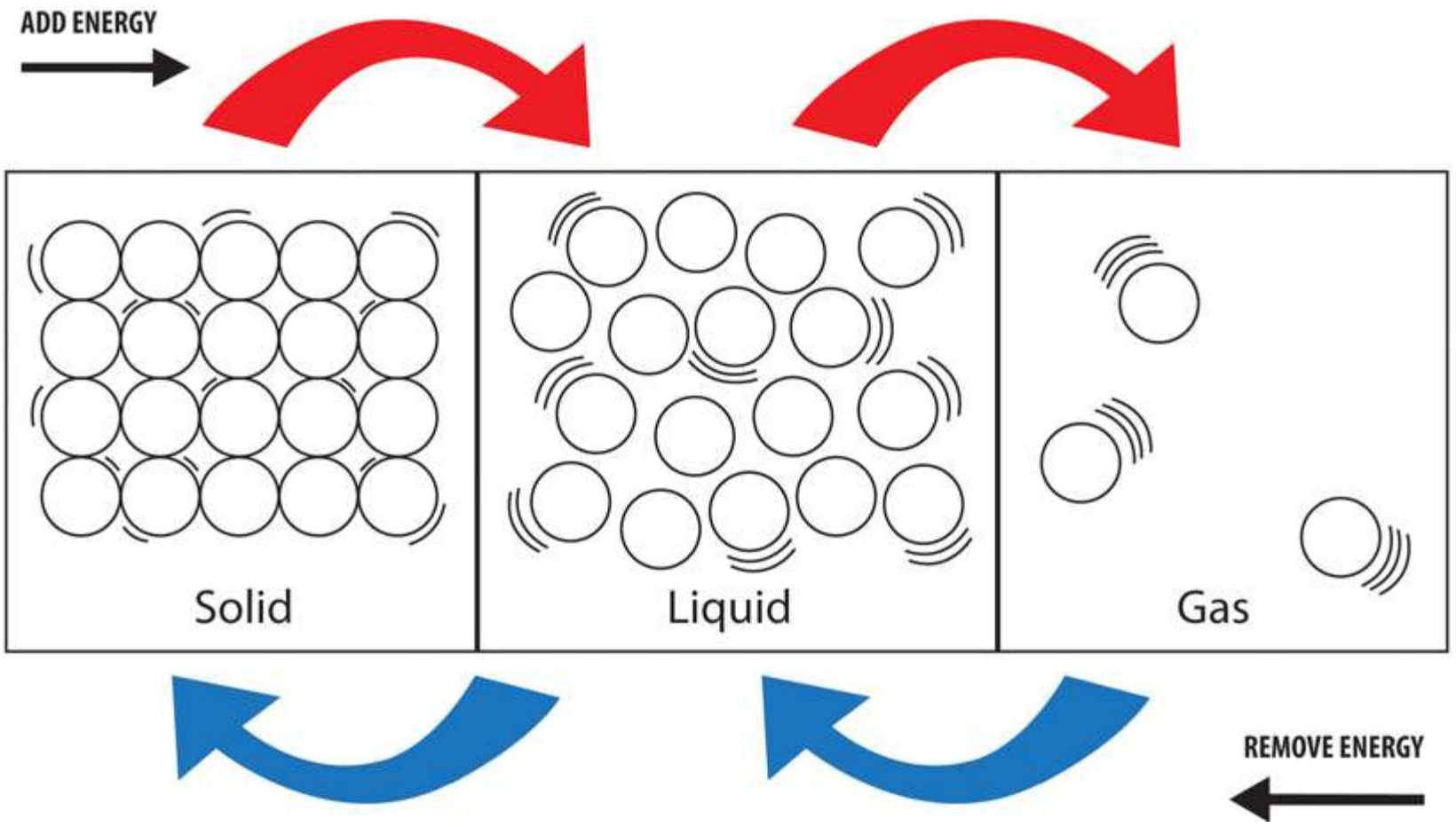


- Condensation is the change of state from a gas to a liquid
- Removing energy (decreasing temperature) from a gas will cause the particles to slow down
- When the attraction between the particles overcomes their motion, the particles clump together to form condensation

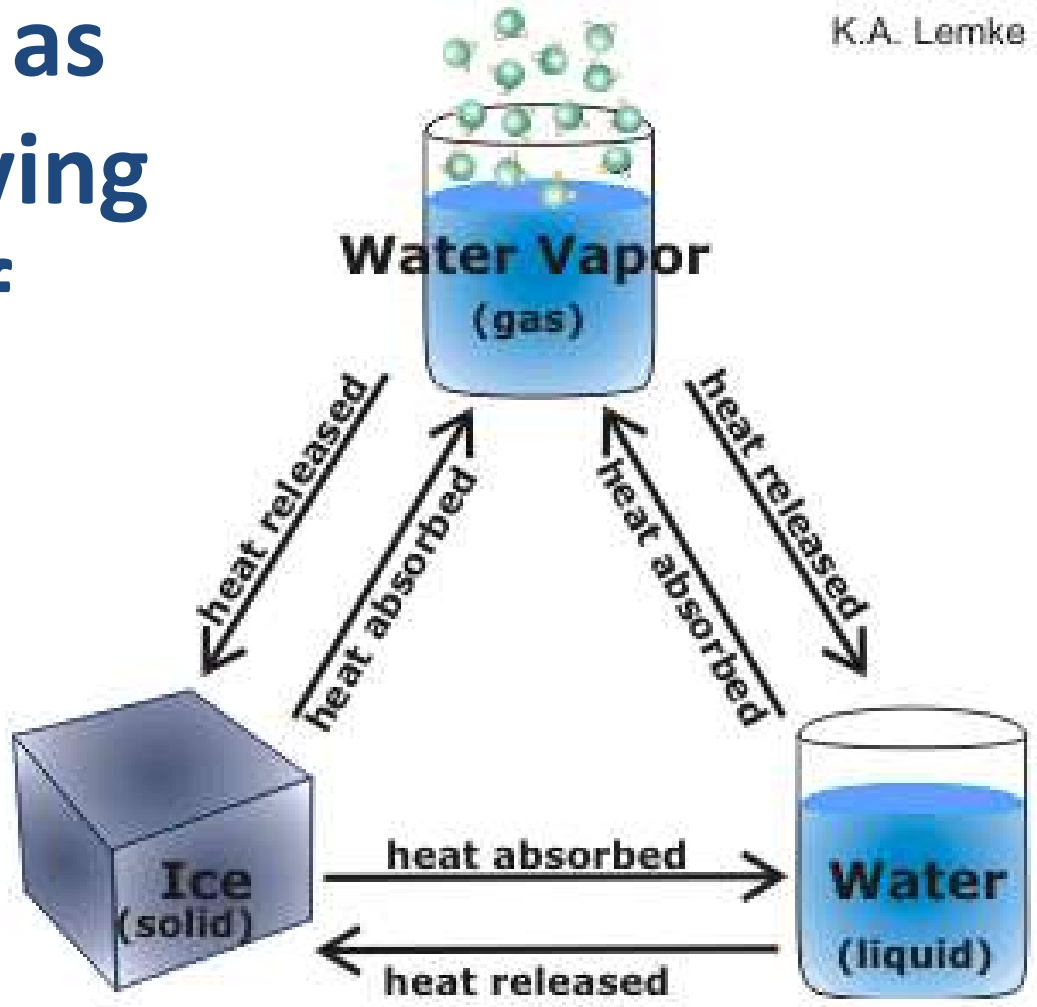
On your notes identify which box represents a solid, liquid, and gas. Then, identify what both arrows represent



Energy and Changes in State



Adding Energy can also be viewed as adding or removing heat (form of energy)



Relationship between Energy, Temperature, and Particle Movement

- When most substances lose or gain energy, one of two things happens to the substance: its temperature changes or its state changes.
- The temperature of a substance is related to the speed of the substance's particles.
- So, when the temperature of a substance changes, the speed of the particles also changes.

Let's see the Effects of Temperature and Particle Movement

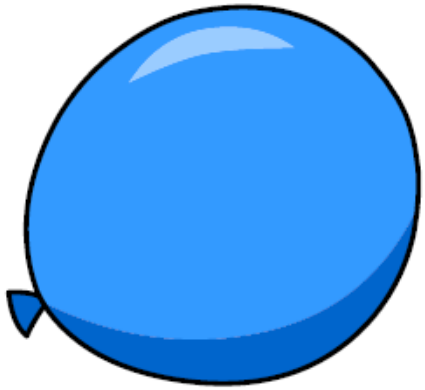
As particles in matter move faster, they push out with greater force and can cause matter to expand

http://www.middleschoolchemistry.com/multimedia/chapter1/lesson4#heating_cooling_metal_ball

Balloon Flux
Constructed Response

Two balloons are filled with an equal volume of air. One is put in the refrigerator for an hour, while the other is heated in a slightly warm oven. Identify which balloon is which, and explain why.

A.



B.