Properties of states of matter Name _____

Part A: States of Matter

Macroscopic Things that are large enough to see and feel are macroscopic.
What happens on a molecular level influences what we experience on a macroscopic level.

Volume The amount of space that matter takes up.
Expansion When something gets bigger.
Contraction When something gets smaller.

State of matter	**How are molecules arranged?**	**How are molecules attracted?**	**How do molecules move?**	**Can it change shape?**	**Can it change volume?**
Solid	Molecules are locked in place (usually in a grid or crystal structure)	Very closely, typically with chemical bonds.	Molecules can only vibrate.	NO	NO
Liquid	Atoms and molecules are able to slide around by other, but still stay connected to each other.	With loose bonds between molecules.	Molecules can vibrate or move relative to each other.	Yes, it takes the shape of the container.	NO
Gas	Atoms and molecules can move freely through a room or container.	With only very loose random attractions.	Molecules can move freely.	YES, it takes the shape of the container	YES, it takes the volume of the container EXPANDS and CONTRACTS

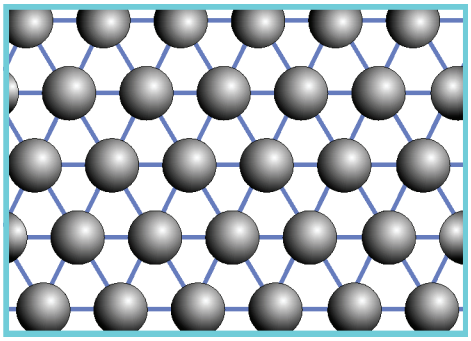
True or False?

Solids take the shape of their container.
Liquids take the shape of their container.
Gasses take the shape of their container.

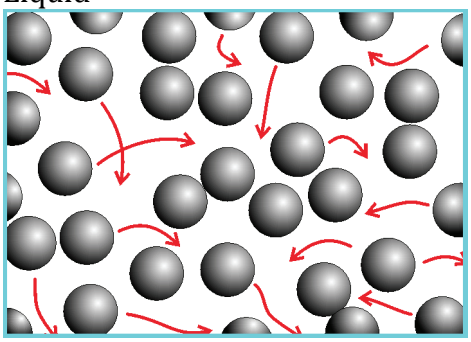
Properties of states of matter Name _____

Solids take the volume of their container.
Liquids take the volume of their container.
Gasses take the volume of their container.

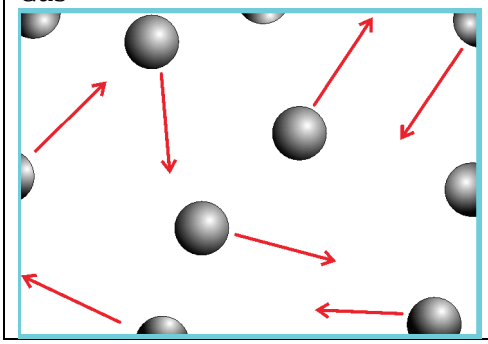
Solid



Liquid



Gas



Imagine an alternate universe where liquids did *not* take the shape of a container. What would happen when you tried to pour a glass of milk? What state of matter is milk acting like?

Imagine a different alternate universe where liquids take the shape *and volume* of a container. What would happen when you tried to pour a glass of milk? What state of matter is milk acting like?

Imagine yet another alternate universe where gasses *did not* take the volume of the room. What might happen as you walked around the room?

Part B: Thermal Expansion

Thermal Expansion of Solids

When the temperature is higher, solids become slightly larger. (expansion)

When the temperature is lower, solids become slightly smaller. (contraction)

(note: also applies to liquids---more complicated with gasses)

B.1 A piece of wood is made of molecules:
B.1a What happens to the molecules if the temperature increases?

B.1b What happens to the whole piece of wood? (What is the macroscopic effect?)

B.1c What happens to the molecules if the temperature decreases?

B.1d What happens to the whole piece of wood? (What is the macroscopic effect?)

B.2 I have a built in cabinet in my house.
In the winter, there is a tiny space between my cabinet and the wall.
In the summer, there is no space between my cabinet and the wall.
Explain this:

B.3 A carpenter is building a cabinet during the winter. He builds so it is perfectly in line with the wall, with absolutely no space between. What is going to happen during the summer?

B.4a What happens to the molecules in a solid when the temperature increases?

B.4b What is happening on a molecular level that causes thermal expansion?

Mercury

A silver, toxic liquid.
Experiences very extreme thermal expansion and contraction.

Thermometer

Mercury in a vial
Due to thermal expansion and contraction, mercury rises and falls with the temperature.

(note: modern thermometers use a nontoxic liquid, not mercury)

B.5 What happens to the mercury in a thermometer when temperature increases?

B.6 What happens to mercury in a thermometer when temperature decreases?

B.7 Explain how a mercury thermometer works:

Part C: Temperature and States of Matter

Temperature
Temperature is the "average molecular kinetic energy" in a substance.

C.1 Write three times "Temperature is average molecular kinetic energy."

If you could take each molecule, one by one, and calculate its kinetic energy, then you took an average, you could determine the temperature of a substance. However, this is not realistic, but we can measure the temperature with a thermometer.