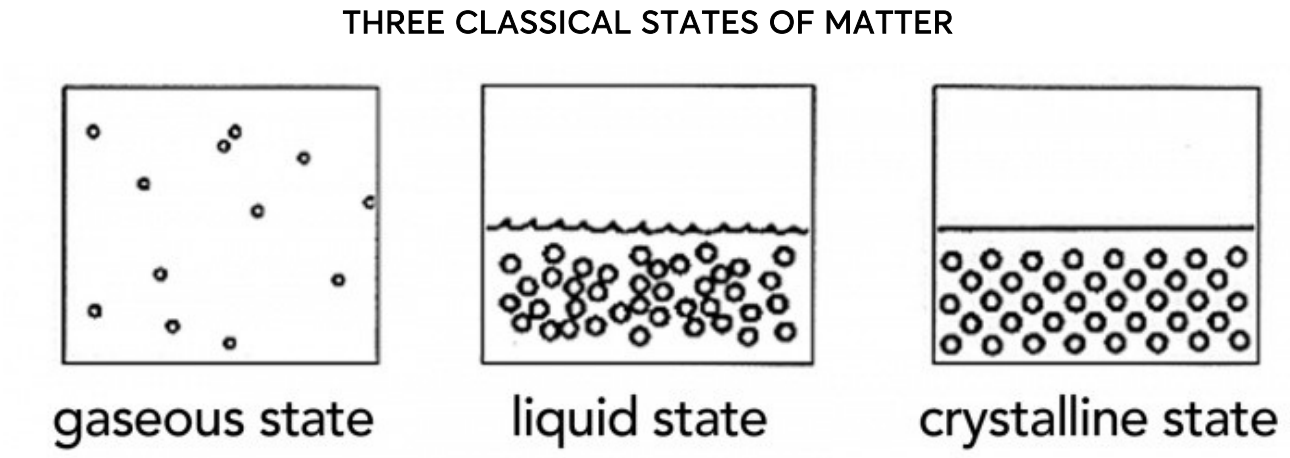
Properties of Glass – State of Matter

PART 2: State of Matter

Glass is unique matter! We might think of glass as being a hard solid—but that isn't the whole truth.

Glass is technically an amorphous solid—neither a liquid nor a solid, but sharing the qualities of both states of matter. It is formed by heating a mixture of dry materials to a liquid-like state. These ingredients are then cooled quick enough to prevent a regular crystalline (solid) structure. As it cools, the atoms become locked in their disordered liquid-like state never forming the perfect crystalline arrangement of solid matter.

Check out the images and descriptions below from our friends at the Corning Museum of Glass:



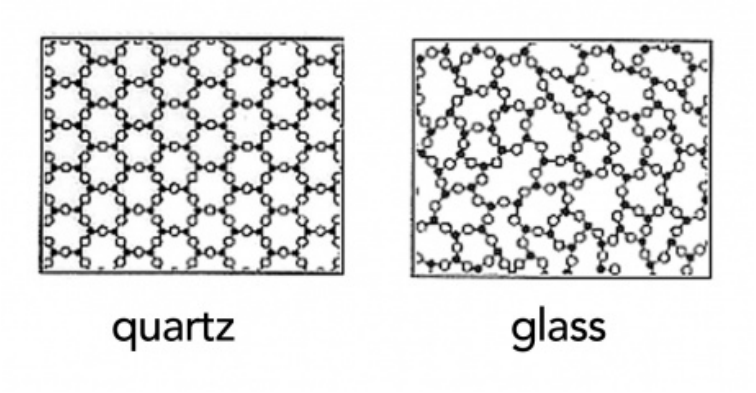
Gaseous state: Individual molecules separated from one another by relatively great distances and moving in a chaotic fashion. No interaction between molecules except for collisions with one another.

Liquid state: Molecules are held close by attractive forces, but are not held rigidly in position. They move about, changing from one disordered state to another.

Crystalline state: Strong attractive forces hold molecules rigidly in position. Each molecule occupies a definite position, in a perfectly ordered three-dimensional lattice.

QUARTZ (A SOLID) VS. GLASS STRUCTURE (IN THE GLASSY STATE)

Glasses have the mechanical rigidity of crystals, but the random disordered arrangement of molecules that characterizes liquids.



How does it work?

Molten (liquid-like) glass is stored in a big bowl in a furnace to keep it hot and liquid-like. The furnace has to stay around 2100°F to keep the glass in this state. That's SUPER hot! In order to work the glass, either a steel rod called a "punty rod" or a large steel straw called a "blow pipe" are used to "gather" or get glass out of the furnace.

Watch this video to see how glassblowers gather glass out of a furnace: https://www.youtube.com/watch?v=4JXAOV3DhGM

When glass is in its molten state, it is hot and drippy like lava with a consistency like honey. Glassblowers must constantly keep their punty rod or blow pipe turning, using centripetal force to keep the glass from going all over the floor! Once glass is removed from its 2100°F home, it immediately starts to cool rapidly. If the glass isn't reheated, it will quickly freeze up and become solid-like.

Our friends at the Chrysler Museum of Art Glass Studio do fun glass performances on the Third Thursday of every month. Watch this playful demonstration of how drippy and malleable hot glass is: https://www.facebook.com/ChryslerMuseumGlassStudio/videos/1361339593931996/

(This performance was created by Gayle Forman, a graduate of the Pittsburgh Glass Center's SiO2 Teen Program. To learn more about our youth programming, visit https://www.pittsburghglasscenter.org/youth-programs)

Activity: Gathering Glass: Honey Toast

Here is what you will need for your honey toast:

- Some kind of rod like a straw, a chopstick, end of a mixing spoon, or a honey dipper
- Honey (make sure it's still a liquid and not solidified)
- Small cup
- Toast

What to do:

1. Make some toast (with help from a grown up if necessary).
2. Put some honey (your molten glass) into a small cup (your furnace).
3. Use the end of your rod to gather a bit of honey from your cup.
4. Try to keep the honey on your rod by turning it constantly. Centripetal force helps you to keep the honey on your rod as you turn.
5. Stop turning and drizzle the honey on your toast. This is what happens to glass when you stop turning, gravity pulls it down.
6. When you're finished, enjoy your toast!

For an additional fun challenge: Try using a utensil with an irregular tip like a butter knife. Do you need to do anything different to keep the honey from dripping off? (Not everything made in glass is round. Sometimes it's easier for sculptors to flip their rods back and forth instead of turning to keep the glass from falling off.)

Additional Video: Watch Bill from the Corning Museum gather honey.
https://www.youtube.com/watch?v=xz1sUH7wDvA

Share Your Toast
Post a photo of your honey toast! Tag us on Instagram, Facebook, or Twitter @pghglasscenter and we might share your creation.