Chapter 12
Solids

OUTLINE

Crystal Structure

Density

Elasticity

Tension and Compression

Error Propagation in Density calculation

CRYSTAL STRUCTURE

- We talked about atoms making up matter
- Some solids are found to have a regularity in the arrangement of their atoms

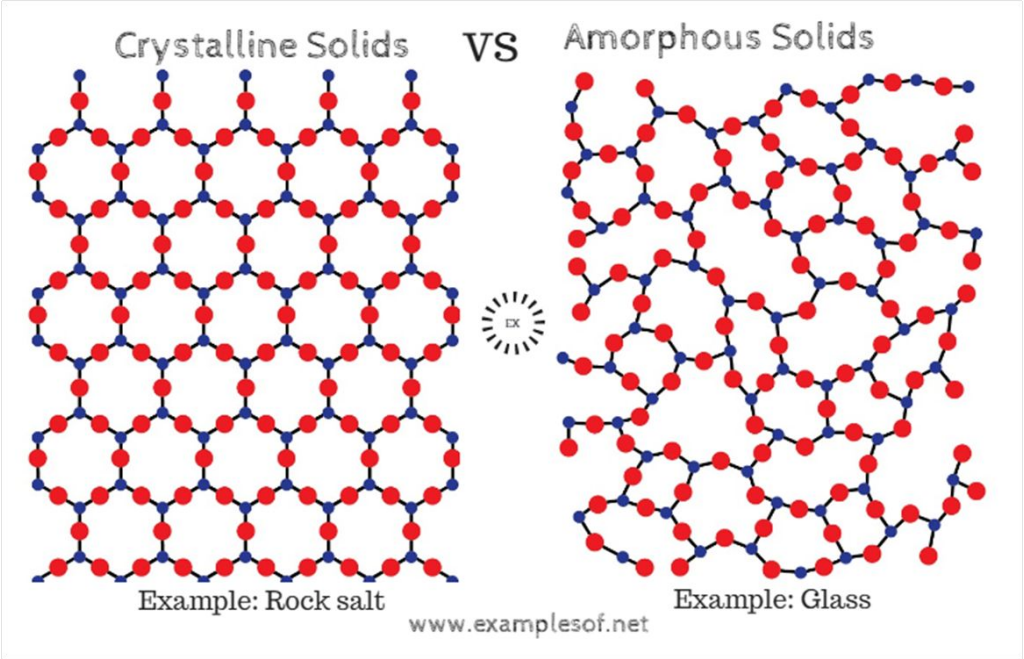
Galena

Quartz

Pyrite

CRYSTAL STRUCTURE

- CRYSTALS are arranged in regular lattices
- AMORPHOUS solids are noncrystalline and have their atoms distributed randomly



How crystals grow

- Crystals can form in liquids that start to cool and harden. Molecules in the liquid rearrange themselves to become stable. This arrangement leads to a uniform repeating pattern that produces the crystallization.

How do crystals work?

https://www.youtube.com/watch?v=PgSRAsgrKmg

Growing your own Crystals

https://www.youtube.com/watch?v=kKLga-8IMiY

Salt Crystal growth under a microscope

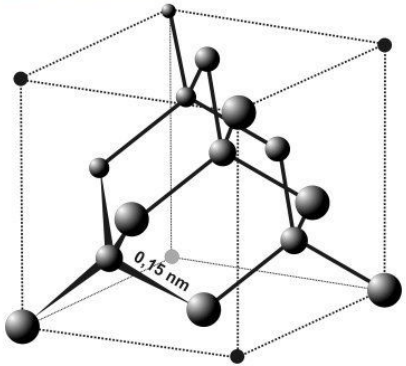
https://www.youtube.com/watch?v=ZTG8FCJZL3M

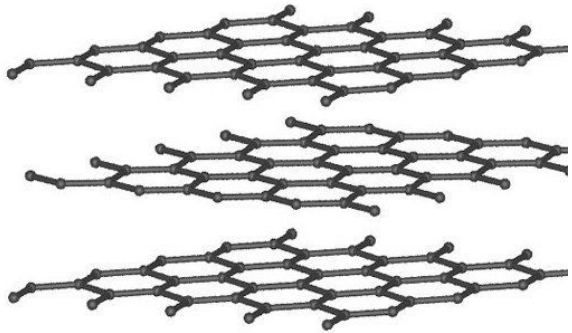
CRYSTAL POWER AND GROWING YOUR OWN CRYSTALS

- There is no experimental evidence that crystals have healing properties.
- Growing your own crystal is an interesting learning activity.
- You can also try to make instant ice (https://www.stevespanglerscience.com/lab/experiments/instant-freeze-soda-ice/)

POLYMORPHS: DIAMONDS VS GRAPHITE

- Diamonds are strong in all directions because carbon atoms are arranged tetrahedrally and are held together by single covalent bonds.
- Graphite on the other hand is “flaky” or fragile as it is composed of stacked sheets
- Just in case you want to watch something funny and learn a little about graphite!





DENSITY

A good way to think about density is to think of the “lightness” or “heaviness” of different materials of the same size.

Typically it is measured by dividing the mass by the volume.

$$p = \frac{m}{v}$$

mass

density

volume

DENSITY

A video that explains the gif in the previous slide. It’s about a gas but it’s a good illustration on what density is.

Measuring Density Experiment

Today we will measure the density of solids made of different materials.

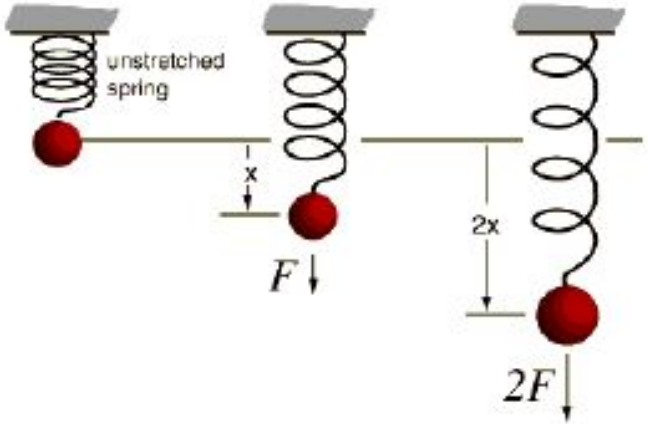
- Measure the mass
- Measure the volume

Note that each dimension in the volume has an uncertainty associated with it. The mass measurement also has an uncertainty measured with it. These all play a part in the final density calculation.

We will learn about the *details* in the final slide.

Hooke's Law

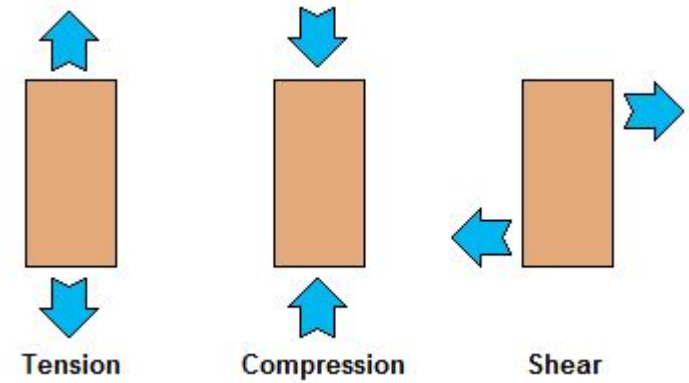
The force needed to stretch a material is proportional to the length that it gets stretched or compressed. This law breaks down when the material reaches its *elastic limit* (point at which permanent distortion occurs).

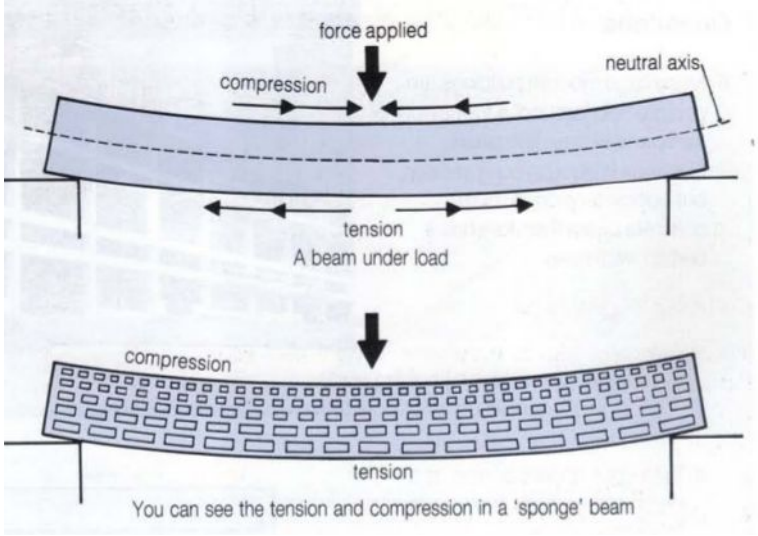


Tension and compression

TENSION - stretched, causes things to get longer and thinner

COMPRESSION - squashed, causes things to get longer and thinner.





UNCERTAINTY IN MEASUREMENT

Determine the value of the *least count* in the measuring device. It's the smallest subdivision given on the measuring device.