

Characteristic Physical Properties



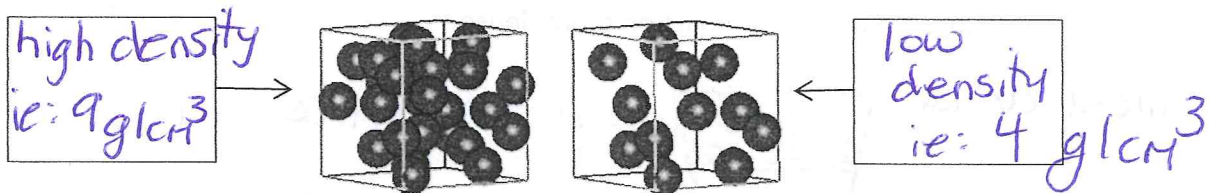
Characteristic Physical Properties are helpful.

- ⊙ Unique physical properties help identify unknown substances quickly! (think about Forensic Chemistry lab)
- ⊙ Testing the physical property doesn't use up the sample.

#1 Density

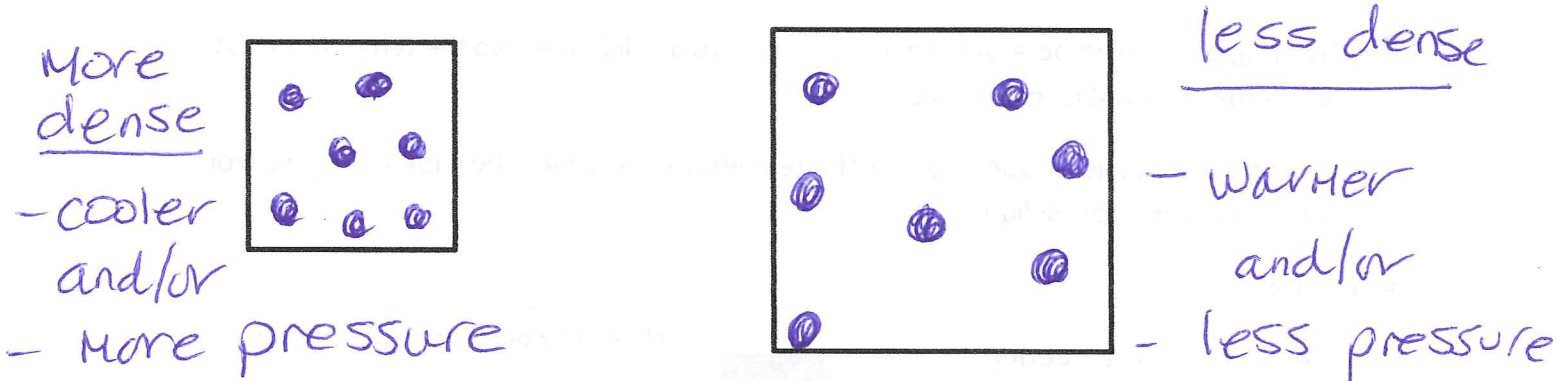
Density is a ratio of mass (grams) per volume (cm^3 or mL). So units are g/cm^3 or g/mL

Density is how much stuff is packed into a standard space.



- ⊙ Particle theory says particles get farther apart as the substance warms.

Gas density is very much affected by temperature & pressure. Higher temperatures and lower pressure allow particles to move farther apart. It's the same # of particles (mass) taking up much more space so the density decreases.



Liquids & solids are not as affected by temperature in pressure since particles are close already.

Generally:

- ⊙ Liquids are more dense than gas

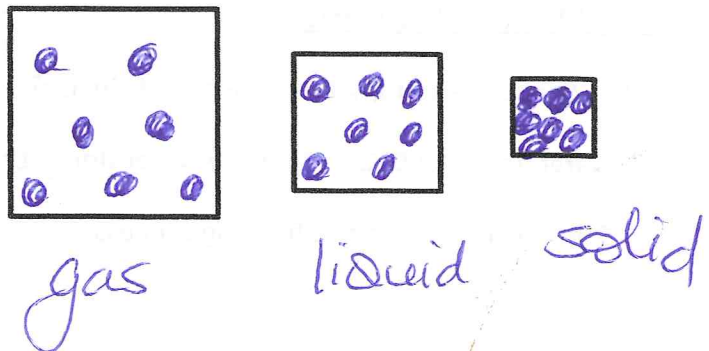


Table of densities: p. 193

Copy down 3 of your favourite metals

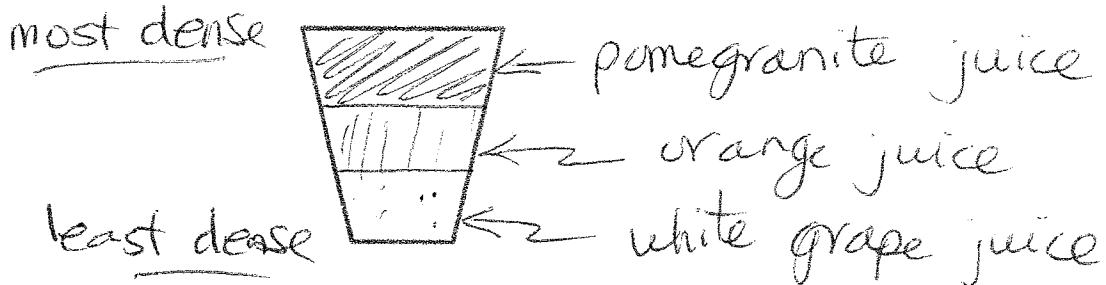
You can do this

Metal	Density (g/cm ³)

Notice that the densities are all different (unique) and this can help identify a mystery metal!

Note: a cm³ is about the size of a sugar cube

Density → explains floating. Less dense floats on more dense.



#2. Freezing/Melting Point & #3 Boiling/Condensation Point

- ⊙ Freezing point = temperature the liquid turns into a solid. It is also the temperature at which the solid will turn into a liquid.
- ⊙ Boiling point / Condensation point is the temperature at which the substance goes from liquid → gas or gas → liquid.

Look at water

- ⊙ Water → melting/freezing = 0° C
- ⊙ Water → boiling/condensation = 100° C

These temperatures are unique!

Looking at Water's Uniqueness

(A) Why does adding salt to roads melt the ice?

Water freezes at 0°C. But salty water doesn't freeze until -16°C!

Salt interferes with the freezing process.

(B) Why does freezing water in bottle crack it?

Most substances get denser when they freeze and take up less space but water actually expands and becomes less dense!

So ice is less dense than water and ice floats on water. That's why ice forms on top of lakes so we can skate on it & ice fish on it.

....and....

ice cubes float in water.

Density Calculations

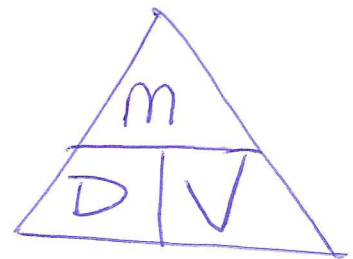
D = density (g/cm^3)

m = mass (g)

v = Volume (cm^3)

Volume = $l \times w \times h$

$$D = \frac{m}{v}$$
$$M = D \times V$$
$$V = \frac{m}{D}$$



Example

Calculate the density of a sample that is 18.0 cm long, 9.21 cm wide and 4.45 high. The mass is 14.25 kg (14250g). What is the metal?

$$D = ?$$

$$D = \frac{M}{V}$$

$$V = l \times w \times h$$

$$= 18.0 \times 9.21 \times 4.45 = 738 \text{ cm}^3$$

$$D = \frac{14250 \text{ g}}{738 \text{ cm}^3} = 19.3 \text{ g}/\text{cm}^3$$

This sample is gold! (see Table 1 pg 193)