

DENSITY

$$D = m/V \quad (\text{g/cm}^3) \quad (= \text{g/mL})$$

- Mass usually expressed in grams
- Volume usually expressed in cm^3 or mL, etc.

Density

- Density = amount of matter per unit volume
- Density is the ratio of mass to volume
- That is, $d = m/V$
 - Predictions: for example, an increase in mass when volume is constant = an increase in density

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The “DMV” Triangle for Volume, Mass, and Density

$$\text{Density} = \frac{M}{V}$$

$$\text{Volume} = \frac{M}{D}$$

$$\text{Mass} = D \times V$$



What would take up more space??? A kilogram of feathers..... or a kilogram of steel??



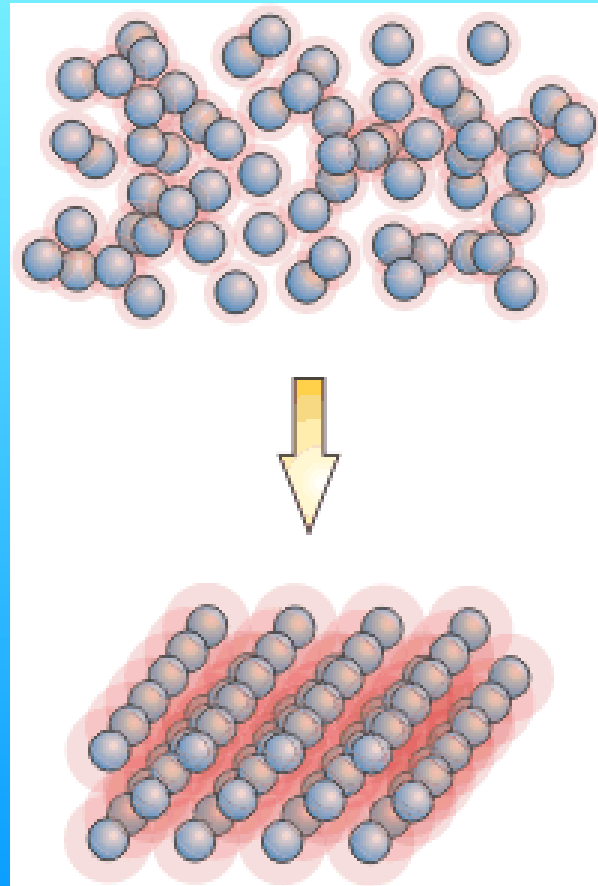
OR



Density is the measure of the “compactness” of a material

- How close the atoms or molecules are to each other
- All substances have density including liquids, solids, and gases

“Compactness” of liquids and gases = greater density. Due to cold or high pressure (squeezing).



Compare the temperature and density of shallow vs deep water.

What do you conclude about density?
Floating or sinking of water?

SOLIDS

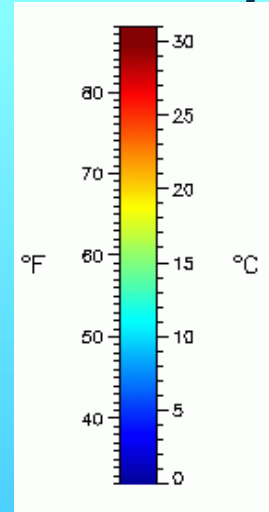
- Ice is less dense than water (which is why lakes and ponds have a thin layer of ice covering in winter, with water underneath)
- Various rocks, woods, metals have a characteristic density specific to that substance. Their density is “not affected” by temperature or pressure.

Wouldn't you like to have a bunch of THIS dense material?



Factors affecting Density

■ Temperature



■ Pressure



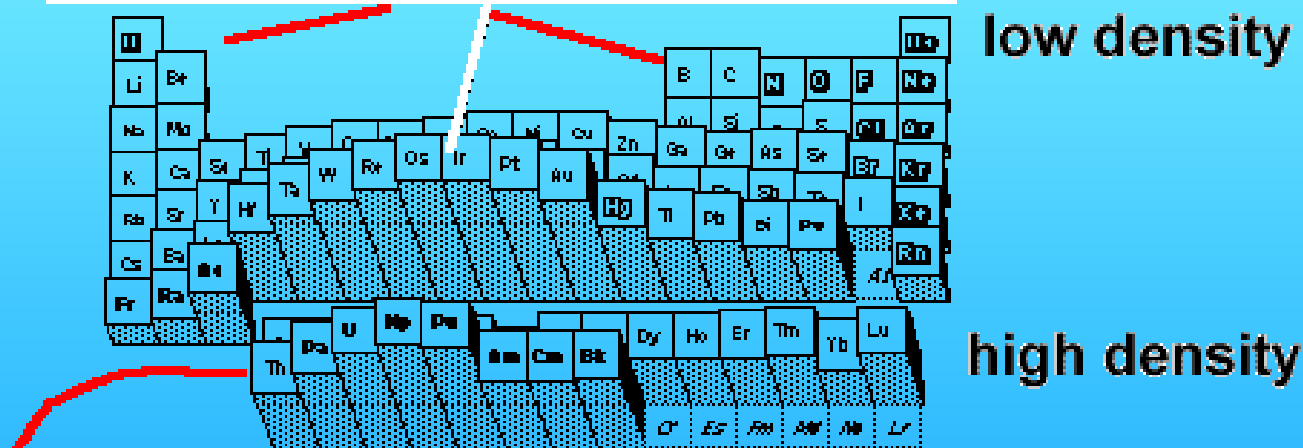
Factors affecting Density

- Dissolved solids - in liquids
 - Concentration and the type of substances

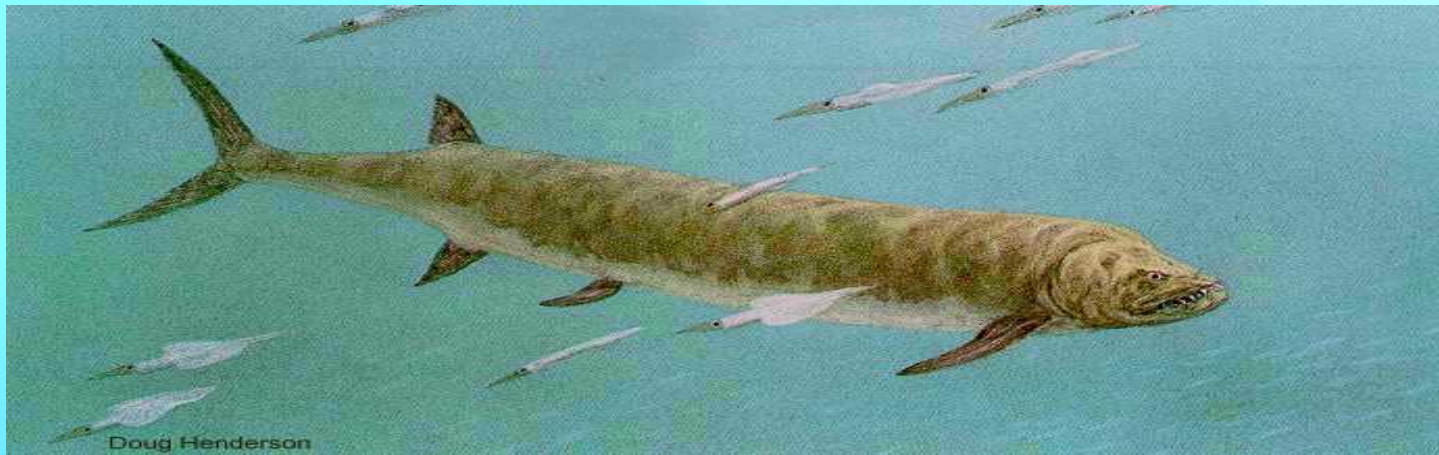


Different elements have different densities.

low density elements at the top



highest density elements are at the bottom
osmium has density of 22.6 g/ml



- How are fish and submarines alike?
- The swim bladder in bony fish control their relative density in order to rise or dive in the water...buoyancy
- When dissolved air from the blood is added to the swim bladder the fish becomes less dense and floats.
- when air is removed the fish becomes more dense and sinks.

Density Table

SUBSTANCE	DENSITY (G/CM ³)
AIR	0.0013
WOOD (OAK)	0.85
WATER	1.00
ICE	0.93
ALUMINUM	2.7
LEAD	11.3
GOLD	19.3
ETHANOL (alcohol)	0.94
METHANOL (fuel)	0.79

SINK or FLOAT
In Water (D = 1.0
g/mL)

Float

Float

Float

Sink

Sink

Sink

Float

Float