$T_K = T_C + 273$

$T_K = 37.0 + 273 \Rightarrow \boxed{T_K = 310\ K}$

ex: Convert 77 K to degrees Fahrenheit.

↳ K → °C → °F

$T_K = T_C + 273 \Rightarrow 77\ K = T_C + 273$

$T_C = -196°C$

$T_F = T_C\left(\frac{9}{5}\right) + 32 \Rightarrow T_F = (-196)\left(\frac{9}{5}\right) + 32 \Rightarrow \boxed{T_F = -321°F}$

⊛ Density = the mass of a substance per unit volume of the substance.

↳ $\text{density} = \frac{\text{mass}}{\text{volume}}$ or $\boxed{D = \frac{m}{V}}$

- liquids = density reported in g/mL.
- solids = density reported in g/cm^3.
- gases = density reported in g/L.

$1\ g/mL = 1\ g/cm^3$

* Water has a density of approximately 1 g/mL. Lead has a density of 11.4 g/cm^3 so it sinks in water. Styrofoam has a density of 0.035 g/cm^3 so it floats in water.

ex: An object weighing 350 lb occupies a volume of $1.2 \times 10^4\ in^3$. Will this object float or sink in water?

↳ $D = \frac{m}{V} = \frac{350\ lb}{1.2 \times 10^4\ in^3}$ → convert to "g/cm^3" and compare...

$\frac{350\ lb}{1.2 \times 10^4\ in^3} \times \frac{453.59\ g}{1\ lb} \times \frac{(1\ in)^3}{(2.54\ cm)^3} = 0.8073 = \boxed{0.81\ g/cm^3}$

↳ don't just cube ** the units !!

↳ object less dense than H_2O, so it floats.

ex: A solid block has a mass of 615.0g. The block is rectangular with length 10.0cm, width 3.5cm, and depth 2.9cm. What's the volume and density of this block?

↳ $V = l \cdot w \cdot h = (10.0\,cm)(3.5\,cm)(2.9\,cm) = \boxed{102\ cm^3}$

→ $1.0 \times 10^2\ cm^3$ is proper sig. figs. answer.

$$D = \frac{m}{V} = \frac{615.0\,g}{102\ cm^3} = \boxed{6.03\,g/cm^3}$$

* Note: if length, width, and heigth were not all in centimeters, we would have needed to convert them to centimeters before calculating the volume.

⊛ The Classification of Matter.

↳ = anything that has mass and takes up space.

- Matter exists in 3 states
  - → a 4th state (plasma) will be ignored.
  - "rigid" → ① solid = has a definite volume and a definite shape.
  - "fluids" → ② liquid = has a definite volume but no definite shape.
  - "fluids" → ③ gas = has no definite volume and no definite shape.

- Matter has many levels of organization, as we shall see on the next page...

Name _____
Period _____ Date _____

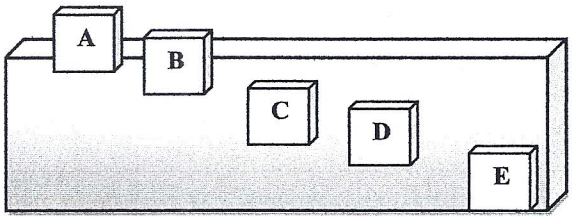
1 · Chemistry Foundations

1.3 NOTES - DENSITY

Opening Question

The density of water is 1 g/mL. Determine the representation results when a 1 kg cube of each of the following is placed in a tub of water.

Substance	Density
Aluminum	2.70 g/mL
Diamond	3.53 g/mL
Ice	0.92 g/mL
Lead	11.3 g/mL
Wood	0.40 g/mL



Density

Which is more dense?

- Cube A: Solid aluminum cube with a volume of 1 L.
  Cube B: Solid aluminum cube with a volume of 2 L.
- Cubes A and B both have the same volume, but cube A has twice the mass of cube B.
- Cubes A and B both have the same mass, but cube A has twice the volume of cube B.

Find the density of a piece of jewelry that has a mass of 30.5 g and a volume of 1.58 mL.

Find the volume of a 4.85 g sample of a sample of acetone if its density is 0.7846 g/mL.

Find the mass of a 20-m^3 piece of Styrofoam if its density is 0.075 g/cm^3.

Density – An intensive, physical property that describes the compactness of a substance. Substances have unique densities at a given physical condition (temperature, pressure).

$$\text{density} = \frac{\text{mass}}{\text{volume}} \qquad D = \frac{m}{V}$$

Example: A spherical lead bullet with diameter 9 mm has a mass of 4.33 g. What is the density of lead in g/cm^3? ($V = \frac{4}{3}\pi r^3$)

Example: A sheet of lead that is 3.0 cm can reduce 99.9% of the intensity gamma radiation. What is the mass of a sheet of lead that measures 1.0 m by 1.0 m?

20-kg blocks of lead and steel are obtained. If the volume of lead block is smaller than that of the steel block, how do their densities compare?

Steps to Solving Problems

1. **<u>Identify</u> the Variables.**
2. **Write the <u>Equation</u> used.**
3. **<u>Substitute</u> Values** into the equation.
4. **Write the <u>Answer</u>** with the correct number of significant figures and the appropriate units.