

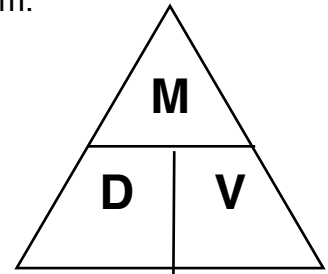
Density

Density is a physical property that can be useful if you have two substances that are similar in appearance and texture and you would like to identify them.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Where mass is measured in kg or g
(1kg= 1000g)

Where volume is measured in m³ or cm³ or mL
(1mL= 1cm³, 1 cm³ = 1000000m³)



Where:
M represents mass
D represents density
V represents volume

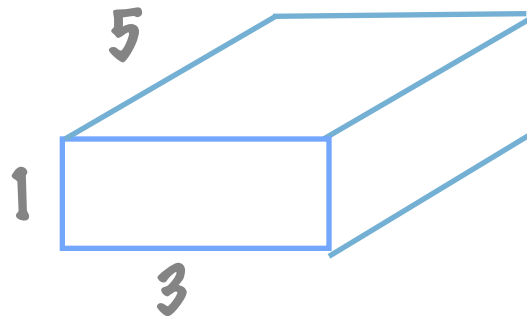
Measuring mass and volume

i) Mass : Weight of the object

ii) Volume: depends if it's a regular or irregular shape

a) Regular: square or rectangular object, measure with a ruler

Example:



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

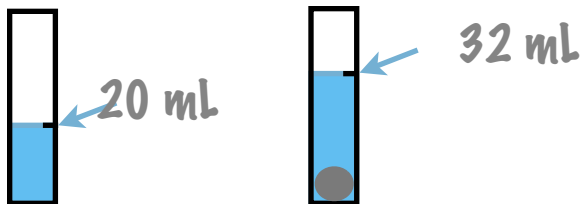
$$V = 5 \times 3 \times 1$$

$$V = 15 \text{ cm}^3$$

b) Irregular: two methods

Graduated Cylinder: Volume of object = final volume - initial volume

Example:



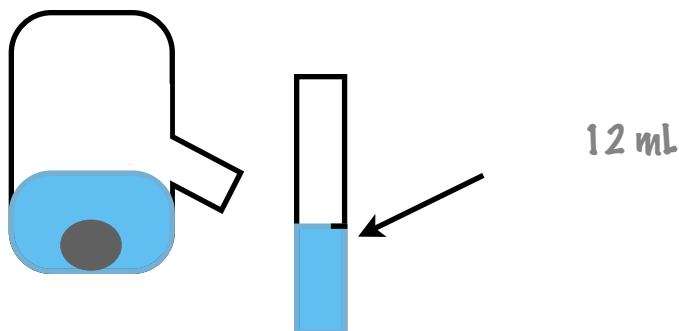
$$\text{Volume of Object} \\ = \text{final volume} - \text{initial volume}$$

$$= 32 \text{ mL} - 20 \text{ mL} \\ = 12 \text{ mL}$$

Overflow Can:

- 1) Fill can to arm. Let excess water drip out
- 2) Place object in can, collect water that is displaced with graduated cylinder
- 3) Read graduated cylinder for volume

Example:



Density and particle theory

- The particle theory states that matter is made up of particles packed together. Some particles can be packed closer than others.
- The same number of particles may take up different volumes depending on how they are packed.

Answer the following questions using the equation given above.

- 1) A diamond with a volume of 2 cm^3 has a mass of 7 g . What is the density of the diamond?
- 2) a) A metal cube measures $5 \text{ cm} \times 3 \text{ cm} \times 2 \text{ cm}$. It has a mass of 642 g . Calculate the density of the cube.
b) Is the cube made of gold? Explain.
- 5) A rubber stopper has a density of 1.70 g/cm^3 and a volume of 75 cm^3 . Calculate the mass of the rubber stopper.
- 7) Cork has a density of 0.2 g/cm^3 . What is the volume of a piece of cork with a mass of 0.4 g ?
- 8) How much space would 100 g of mercury occupy? The density of mercury is 13.6 g/cm^3 .

Substance	Density (g/cm^3)
Air	0.0013
Feathers	0.0025
Oak	0.6
Ice	0.92
Water	1.00
Bricks	1.84
Aluminum	2.70
Steel	7.80
Silver	10.50
Gold	19.30

Communication/Application

11) Around 250 B.C. Archimedes, a Greek mathematician, was asked to determine whether a craftsman had defrauded the King by replacing some of the gold in the royal crown with silver. While thinking one evening in the bathtub, Archimedes made a startling discovery that allowed him to solve the King's problem. Legend has it that he ran naked through the streets shouting "Eureka! Eureka!". Speculate as to how Archimedes figured out how to determine if the crown was made of gold. Be specific.