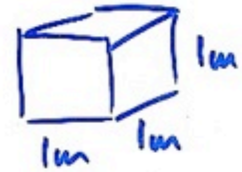
Announcements

1. Quizzes start next week!
   - 1st 15 minutes of lab (M345)
2. ARIS
   - Assignment goes up on FRIDAYS by 5pm.
   - Due: Following FRIDAY by 9AM
   - Single Submission
     - but can check answers + go through tutorials ∞ times.
3. Labs next week!
   - Manual!
   - Goggles!
   - Proper attire!
4. Lecture slides are on website for Ch1-4. PRINT OFF!
5. Blackboard is on! Grades soon...

Volume

No SI unit:
there is a derived unit: m^3.



$V = 1 m^3$.
LARGE!

Smaller unit: Liter (L)

$V = 1000\ cm^3 = 1\ L$

$V = 1\ cm^3 = \frac{1}{1000} \cdot L$
$= 1\ mL$

$1 cm^3 = 1 mL$
$1000 mL = 1 L$
$1 cc = 1 cm^3 = 1 mL$

mL
L

Density

- Defined: $\frac{\text{mass}}{\text{volume}} = \text{Density}$

mass ← extensive

volume ← extensive

Density ← intensive

convenient units...

mass (g)

volume (mL or cm^3)

typically...

density has units of $\frac{g}{mL}$ or $\frac{g}{cm^3}$

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

$$d = \frac{m}{V}$$

Algebra!!

$d = m/V$ ... what's $m = d \times V$

$$V \times d = \frac{m}{\cancel{V}} \times \cancel{V}$$

— what's $V = m/d$

$$V \times d = \frac{m}{\cancel{V}} \times \cancel{V} \Rightarrow \frac{m}{d} = \frac{V \times \cancel{d}}{\cancel{d}}$$

Table 1.4

Densities of Some Substances at 25°C

Substance	Density (g/cm^3)
Air*	0.001
Ethanol	0.79
Water	1.00
Mercury	13.6
Table salt	2.2
Iron	7.9
Gold	19.3
Osmium†	22.6

* Measured at 1 atmosphere.
† Osmium (Os) is the densest element known.

Mercury: Hg

$d = 13.6\ g/cm^3$

Q1. What volume will 20.4g occupy?

$d = m/V_?$ $\Rightarrow V = \frac{m}{d} = \frac{20.4g}{13.6\ g/cm^3}$

$\Rightarrow V = 1.50\ cm^3$

$\frac{g}{g/cm^3}$ ↙ $g \times \frac{cm^3}{g}$

What mass will 0.50 mL of Hg have?

$d = \frac{m}{V}$. $d = 13.6\ g/cm^3$

$m = d \times V = 13.6\frac{g}{cm^3} \times 0.50\ mL$

$= 6.8g$

Handling #'s

Large + Small #'s.

Scientific Notation! $x \times 10^y$

ex: radius of H-atom

0.000 000 000 053m (3, 6, 9, 11) — small #s < 1

$= 5.3 \times 10^{-11}\ m$ — negative

H-atoms in 1-g

602 000 000 000 000 000 000 000 (23, 21, 18, 15, 12, 9, 6, 3)

$6.02 \times 10^{+23}$

Significant figures.

- there is always an error in measurements.
- When we calculate based on several measurements, the error builds up!

Scale

estimate to 1/10 of division.

2 cm? 3 cm?

$2\,cm + \frac{6}{10} \times 1\,cm = 2.6\,cm$

2 ← certain; 6 ← uncertain ±1

(2.5 – 2.7 cm)

Significant figures (sig. figs / s.f.) are the # of certain digits + 1

⇒ 2.6 cm (2 s.f.)

Counting Significant Figures.

Rules: (1) Any non-zero digit ✓

ex: 12.81 s (4 s.f.)
↑ ±1

(2) Any captive zero ✓

ex: 7804 kg (4 s.f.)
↑ ±1

(3) Leading zero ✗

0.0018032 m (5 s.f.)