Announcements

Monday, August 31, 2009

MasteringChemistry (MC) login information is on the course webpage

Upcoming MC due dates (all at 11:59 pm):

- Intro: Fri Sep 4 (not for credit)
- Ch 1: Fri Sep 4
- Ch 2: Fri, Sep 18
- Ch 3: Fri, Sep 25

Spreadsheet 1 lab due in D2L dropbox by next Monday (Aug 31) before lab. See lab report submission guidelines (handed to you in lab, and on class webpage).

D2L Discussions are open - start by introducing yourself, then remember you need at least one post per chapter in the chapter discussions for participation points.

Volume

amt 3-D space

derived unit

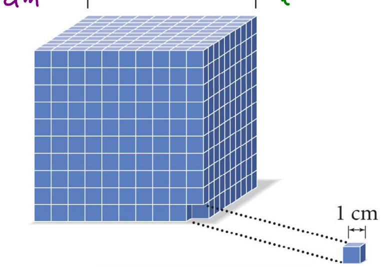
$V = \ell^3$ (cube)

$= 1\ dm^3$

$= 1\ L$ (liter)

$= 1000\ cm^3$

$(10\ cm) \times (10\ cm) \times (10\ cm)$

1 dm = 

= ℓ

A 10-cm cube contains 1000 1-cm cubes.

d = .1
c = .01
m = .001

$1000\ cm^3 = 1\ L$

$1000\ mL = 1\ L$

$(1000)\left(\frac{1}{1000}\right)$

$1\ cm^3 = 1\ mL = 1\ cc$ — Same unit

$1\ mL = \frac{1}{1000}\ L = 1 \times 10^{-3}\ L = .001\ L$

$1\ L = 1000\ mL = 1 \times 10^3\ L$

Density

another derived unit

D = $\frac{\text{mass}}{\text{volume}}$ (mass per unit volume)

TABLE 1.4 The Density of Some Common Substances at 20 °C

Substance	Density (g/cm^3)
Charcoal (from oak)	0.57
Ethanol	0.789
Ice	0.917 (at 0 °C)
Water	1.00 (at 4 °C)
Sugar (sucrose)	1.58
Table salt (sodium chloride)	2.16
Glass	2.6
Aluminum	2.70
Titanium	4.51
Iron	7.86
Copper	8.96
Lead	11.4
Mercury	13.55
Gold	19.3
Platinum	21.4

Density is an **intensive property**

does not depend on amount.

gas densities

usu. g/L

~1 - 4 g/L common gases

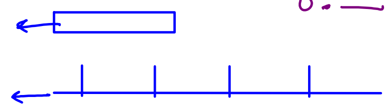
If an object has a mass of 14.3 g and a volume of 7.81 mL, what is its density in g/cm^3?

$D = \frac{m}{V} = \boxed{1.83\ g/cm^3}$

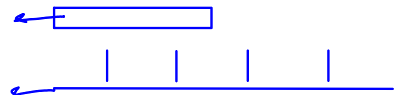
$= \frac{14.3g}{7.81mL} = \frac{14.3g}{7.81cm^3}$

Reliability of measurements

8.3 cm ← 1 uncertain digit (or 8.2 cm, 8.4 cm) etc. (± .1 cm)



8.65 cm (8.64, 8.66 etc)



8.65, 8.64, 8.66 cm (± .01 cm)

standard deviation is measure of uncertainty (small stdev = more precise)

Accuracy: "correctness"

Closeness to accepted value

- % error = $\frac{|\text{exp} - \text{theo.}|}{\text{theo.}} \times 100\%$

Precision: "repeatability"

how close values are to each other

– std. deviation (minimize)

Significant figures

In a proper **measurement:** (1 uncertain digit)

Significant:
- All nonzero digits
- Trapped zeroes
- Trailing zeroes **IF** there's a decimal point (to the right)

Not significant:
- Leading zeroes (to left)
- Trailing zeroes **IF** there's **NO** decimal point (assumption)

0.01020 cm — 4 sf

42,000 cm — 2 sf (at least)

42,000. cm — 5 sf

4.20×10^4 cm — 3 sf

Scientific notation

1.23×10^{-4} = small #

.000123

14000. → 3 sf → 1.40×10^{4} pos exp. makes it a big #

Calculations with sig figs

Multiplying or dividing: Round answer to measurement with least number of **sig figs**

$$\frac{2.83\ \text{g}}{1.3\ \text{mL}} = 2.2\ \text{g/mL}$$

3 sf / 2 sf → 2 sf

Adding or subtracting: Round answer to least number of **decimal places**

12.3 cm + 1.24 cm = 13.5 cm — 1 dp

Combination calcs: only round **once** at the end

$$\frac{12.34\ \text{g} + 1.3\ \text{g}}{14.896\ \text{mL} - 2.45\ \text{mL}} = \frac{13.64\ \text{g}}{12.446\ \text{mL}}$$

2 dp, 1 dp → 1 dp

$$= \frac{13.64\ \text{g}}{12.446\ \text{mL}} = 1.09593\ldots = 1.10\ \text{g/mL}$$

Dimensional analysis (unit conversion)

By definition, 1 in = 2.54 cm (exactly)

Possible conversion factors:

$\frac{1\ in}{2.54\ cm}$ or $\frac{2.54\ cm}{1\ in}$

How many centimeters are in 4.358 inches? given

$\frac{4.358\ in}{(1)} \cdot \frac{2.54\ cm}{1\ in} = 11.07\ cm$ (4 sf)

exact

Express 148 μm in kilometers.

$\mu = 10^{-6}$
$k = 10^{3}$

μm → m → km

$148\ \mu m \times \frac{10^{-6}\ m}{1\ \mu m} \times \frac{1\ km}{10^{3}\ m} = 1.48 \times 10^{-7}\ km$

sci. notation

$1\ \mu m = 10^{-6}\ m$ $1\ km = 10^{3}\ m$ 148 x 1E-6 ÷ 1E3 =

$(1\ m = 10^{6}\ \mu m)$

Express 0.0031 Mg in ng

$M = 10^{6}$, $n = 10^{-9}$

$0.0031\ Mg \times \frac{10^{6}\ g}{1\ Mg} \times \frac{10^{9}\ ng}{1\ g} = 3.1 \times 10^{12}\ ng$

$\times \frac{1\ ng}{10^{-9}\ g} =$