8/31/18

ex: 1 Kilometer $= 1 \times 10^3$ m

$1\text{ km} = 1 \times 10^3\text{ m}$

ex: 1 microsecond $= 1 \times 10^{-6}$ s

$1\,\mu\text{s} = 1 \times 10^{-6}\text{ s}$

Can use this idea to make conversions!

ex: $28\,\mu\text{s} \longrightarrow ?\text{ ns}$

plan: SI prefix → base → new SI prefix

$\mu\text{s} \leftrightarrow \text{s} \leftrightarrow \text{ns}$

$1\,\mu\text{s} = 1 \times 10^{-6}\text{ s}$ // $1\text{ ns} = 1 \times 10^{-9}\text{ s}$

$$28\,\mu\text{s} \times \frac{1 \times 10^{-6}\text{ s}}{1\,\mu\text{s}} \times \frac{1\text{ ns}}{1 \times 10^{-9}\text{ s}} = 28{,}000\text{ ns}$$

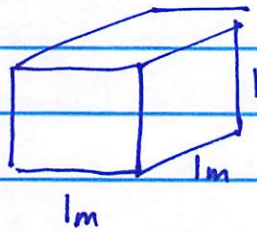
$1 \times 10^{-6} = 1\text{EE}(-)6$ $\quad 1 \times 10^{-9} = 1\text{EE}(-)9$

Sometimes we need to create a unit from combination of the base SI units.

DERIVED UNIT

ex: speed has units of m/s

volume?

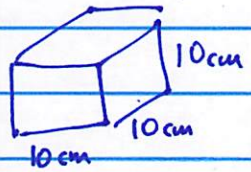


$V = \ell^3 = (1m)^3$

$= 1 m^3$

derived unit for volume.

Common in lab to use:



$V = \ell^3 = (10cm)^3 = 1{,}000\ cm^3$

$1\ Liter = 1\ L$

$1\ L = 1000\ cm^3$

$\frac{1}{1000}\ L = 1\ cm^3$ (milli) OR $1\ mL = 1\ cm^3$

Density

extensive properties — depend on amount

define: $\text{density} = \frac{\text{mass}}{\text{volume}}$ OR: $d = \frac{m}{V}$ ~ g typical, V ~ cm^3 or mL

$\frac{g}{cm^3}$ OR $\frac{g}{mL}$

useful: INTENSIVE PROPERTY (not dependent on amount)

→ can use to ID substances

water, $d = 1.0\ g/cm^3$ gold $d = 19.3\ g/cm^3$

ethanol, $d = 0.79\ g/cm^3$ lead, $d = 11.4\ g/cm^3$

ex: "gold nugget" has mass = 59.9g

volume = $5.25\ cm^3$

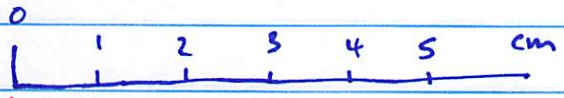
$$d = \frac{m}{V} = \frac{59.9\ g}{5.25\ cm^3} = 11.4\ g/cm^3$$ ~~gold~~

Measurements + certainty

- Almost never 100% certain!
- How certain are we?
  - in general, we are uncertain by ±1 in last digit.

ex: 8.2mL (certain, uncertain ±1) 3.14kg (certain, ±1)

true vol: 8.1 – 8.3mL mass: 3.13 – 3.15 kg



ruler:

object

estimate to 1/10 division

length = 2.5 cm ±1

2.4 – 2.6 cm

We can talk about how PRECISE a ~~mes~~ measurement is by counting the # of significant figures.

#certain digits + 1