

Units Conversion

- ◆ 1.0 milligram (mg) is **same as** $1/1000$ gram (g) = 0.001 g = 1.0 mg
 - ◆ milli = 1×10^{-3}
 - ◆ milligrams per liter (**mg/l**) are equal to **parts per million (ppm)**
- ◆ 1.0 microgram (ug) is **same as** $1/1,000,000$ gram = 0.000001 g
 - ◆ micro = 1×10^{-6}
 - ◆ micrograms per liter (**ug/l**) are equal to **parts per billion (ppb)**
- ◆ 1.0 nanogram (ng) is **same as** $1/1,000,000,000$ gram = 0.000000001 g
 - ◆ nano = 1×10^{-9}
 - ◆ nanograms per liter (**ng/l**) are equal to **parts per trillion (ppt)**

Please Note!

“milli” comes from the Latin for thousand. So how come mg/l is also called “parts per million” (ppm)?

It has do to with the fact that the term “parts per million” is a weight-to-weight ratio. A liter of water weighs approximately 1,000 gram/l or 1,000,000 mg/l.

Thus, 1 mg/l is equal to 1 ppm.



Units Conversion (cont)

- ◆ 1,000 ug in 1 mg
- ◆ 1,000,000 ng in 1 mg
- ◆ 1,000 ng in 1 ug

Or look at it backwards

- ◆ 0.001 mg in 1 ug
- ◆ 0.000001 mg in 1 ng
- ◆ 0.001 ug in 1 ng

Units Conversion (cont)

"I'll try remember all that !"

"More Bigger"



"More Smaller"



◆ **grams >> milligrams >> micrograms >> nanograms**

◆ **Move 3 decimal places between each conversion**

◆ **Bigger to Smaller: decimal moves rightward(ish) →**

◆ **Smaller to Bigger: decimal moves leftward(ish) ←**

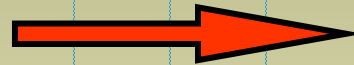


Example

Shifting the decimal three places

Convert 32.1 ug/l (ppb) to mg/l (ppm)

32.1 ug/l
↑



3.21
↓

Shift decimal one place left

0.321
↓

Shift decimal second place to the left

0.0321
↓

Shift decimal third place to the left, to complete the units conversion

0.0321 mg/l

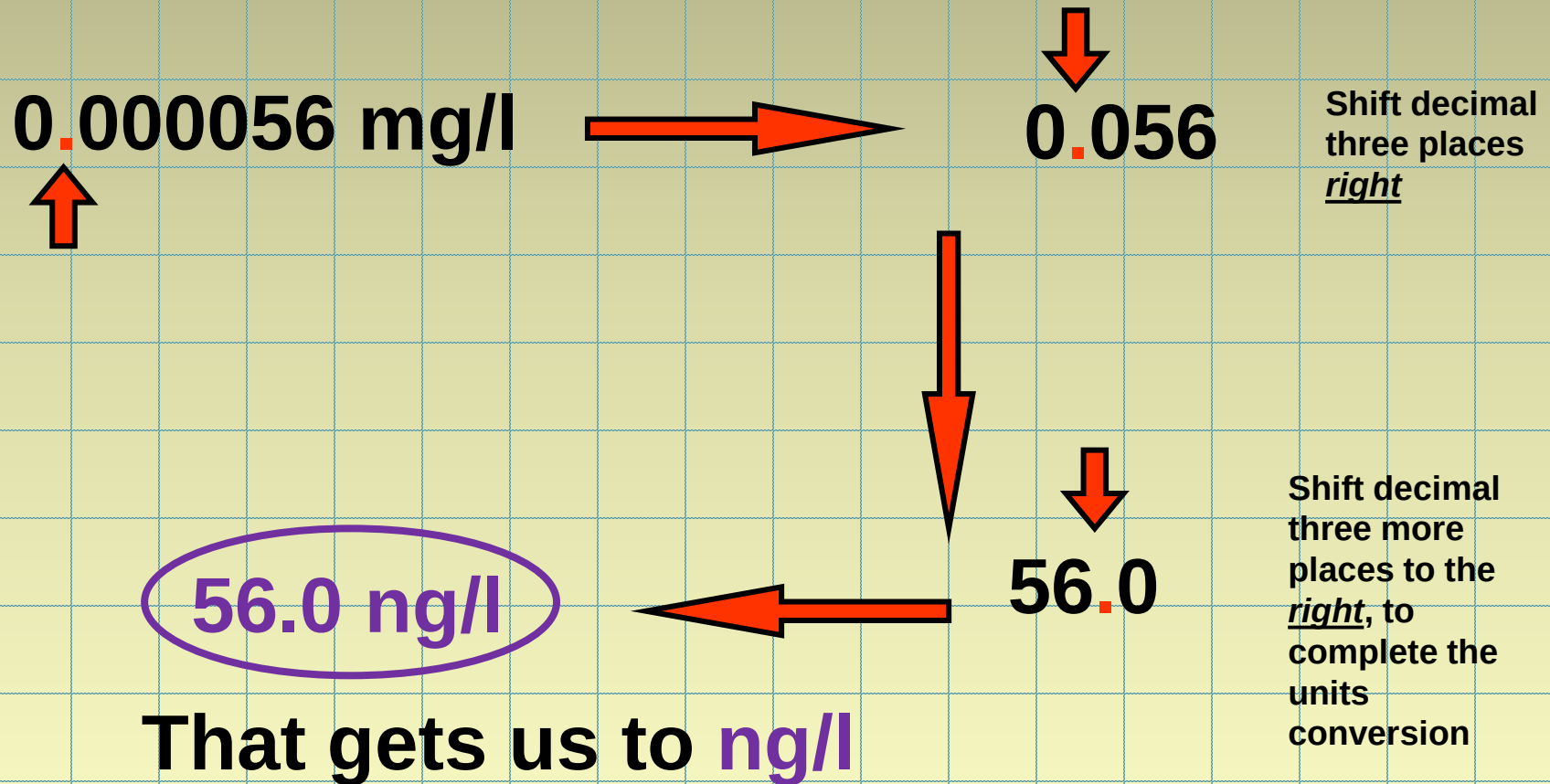


That gets us to mg/l

Example

*Shifting the
decimal six
places*

Convert 0.000056 mg/l (ppm) to ng/l (ppt)



Example

Shifting the decimal three places

Convert 5.6 ng/l (ppt) to ug/l (ppb)

5.6 ng/l
↑



56.0
↓

Shift decimal one place right



560.0
↓

Shift decimal second place to the right



5600.0
←

Shift decimal third place to the right, to complete the units conversion



5600 ug/l

Now we are at ug/l!



Tip

Always remember mercury, Hg, EPA
Method 1631, Practical Quantitation
Level (PQL):

$$1 \text{ ng/l} = 0.001 \text{ ug/l} = 0.000001 \text{ mg/l}$$

“Smallish”

“Still Smallish”

“Still, Same Smallish”

Concentration Analogies

◆ One-Part-Per-Million (ppm or mg/L)

- ◆ *one automobile in bumper-to-bumper traffic from Cleveland to San Francisco*
- ◆ *one inch in 16 miles*
- ◆ *one minute in two years*
- ◆ *one ounce in 32 tons*
- ◆ *one cent in \$10,000*

Concentration Analogies cont.

◆ One-Part-Per-Billion (ppb or ug/L)

- ◆ *one 4-inch hamburger in a chain of hamburgers circling the earth at the equator 2.5 times*
- ◆ *one silver dollar in a roll of silver dollars stretching from Detroit to Salt Lake City*
- ◆ *one kernel of corn in a 45-foot high, 16-foot diameter silo*
- ◆ *one sheet in a roll of toilet paper stretching from New York to London*
- ◆ *one second of time in 32 years*

Concentration Analogies cont.

◆ One-Part-Per-Trillion (ppt or ng/L)

- ◆ *one square foot of floor tile on a kitchen floor the size of Indiana*
- ◆ *one drop of detergent in enough dishwater to fill a string of railroad tank cars ten miles long*
- ◆ *one square inch in 250 square miles*
- ◆ *one mile on a 2-month journey at the speed of light*