

Activity Overview

Participants fill in a table converting parts per million or parts per billion to either mg/kg and $\mu\text{g}/\text{kg}$ (for soil) or mg/L and $\mu\text{g}/\text{L}$ (for water).

When to Use It

When you need to compare test results with standards, but they're not in the same units. They need to be in the same units before comparing.

Suggested companion activities

- May be needed after Making Sense of the Data.
- Accompany with the appropriate handouts from Common Units.
- This skill may be needed before doing The Summary vs. The Lab, Compare to Standards, or As Toxic As...?

Steps

- 1. Launch the activity:** We have our [soil/water] data, but they don't always use the same units. This will help us practice converting between those different units. (Pass out the ppm/ppb handout. Review the relationship between ppm/ppb and units in [soil/water].)
- 2. In pairs:** Here's a chance to practice converting between units. (Pass out the [soil/water] worksheet. Optional: Use a calculator if people need help getting started.)
- 3. Debrief:**
 - How did this go? Was it hard or easy?
 - (If applicable) Do you feel ready to try this with our own data?

Worth Noting

Some people quickly and easily catch on to equivalent units. Others will need a lot of coaching. They may multiply by 1,000 when they should divide instead. If participants struggle, they can start by using a calculator. You can also suggest they break 1,000 down into three tens (e.g., $1.5 \rightarrow 15 \rightarrow 150 \rightarrow 1,500$).

With help, once they have a chance to convert a few results from one unit to another, they may start to see patterns, and begin to feel more certain about the relationships between units. This will help them be able to respond more quickly and flexibly in situations where numbers get thrown around.

Smart Moves

- Play with different ways to say it
- Seek verification

Skill: Build fluency converting between units

Time: 20 minutes

Preparation

Choose which worksheet you will use: *Soil Contamination* or *Water Contamination*

Review the ppm/ppb handout in *Common Units* and the participant instructions.

If you are unfamiliar with the units themselves, review the handout *Common Units* about kg/mg/ μg (and Liters, if needed).

Materials

Answer sheet (1 per facilitator)

Worksheet (1 per participant)

Ppm/ppb handout from *Common Units* (1 per participant)

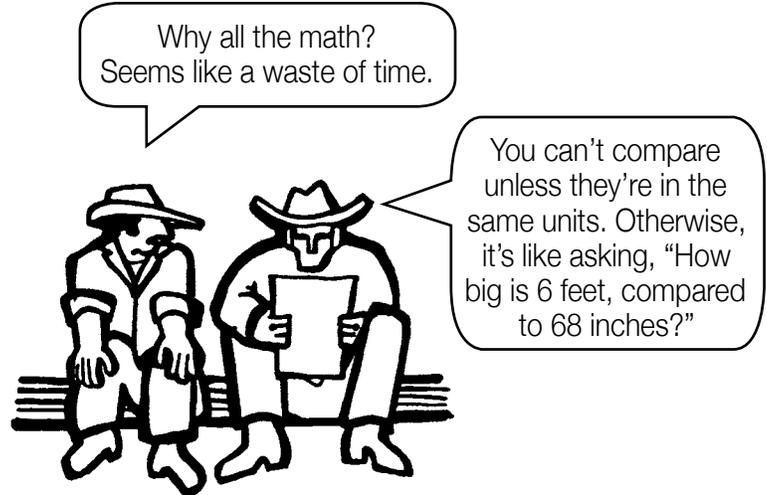
Pens or pencils (1 per participant)

Calculators (a few for the group to share, optional)

Contaminant	Sample Results (in ppb)	Sample Results in mg/kg	Soil Screening Levels Residential Standards*	
			in mg/kg	in ppb
Benzo(a)anthracene	6,780	6.78	1.1	1,100
Benzo(a)pyrene	6,380	6.38	1.3	1,500
Benzo(b)fluoranthene	1,030	1.03	1.5	1,500
Dibenzo(a,h)anthracene	280	0.28	0.2	200
Fluoranthene	2,640	2.64	3,100	3,100,000
Fluorene	33	0.033	3,100	3,100,000
Indeno(1,2,3-cd)pyrene	920	0.92	0.86	860

Soil Contamination

One ppm is the same as 1,000 ppb, and one mg/kg is the same as 1,000 µg/kg. In soil, mg/kg is the same as ppm, and µg/kg is the same as ppb.



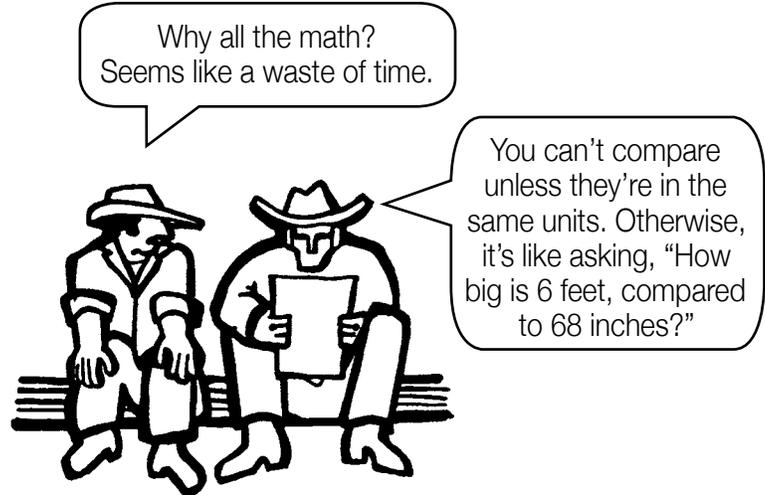
Directions

1. The sample results use different units from the state screening levels. Convert the sample results to the same units as the screening levels, and write them in the table below.
2. Then, just to be sure, convert the screening levels to the same units as the sample results.
3. Compare the sample results in mg/kg with the screening levels in mg/kg. Which sample results are higher than the screening levels? Circle them.
4. Now check your work: Compare the sample results in ppb with the screening levels in ppb. Which sample results are higher than the screening levels? Do they match with the ones you already circled?

Contaminant	Sample Results (in ppb)	Sample Results in mg/kg	Soil Screening Levels Residential Standards*	
			in mg/kg	In ppb
Benzo(a)anthracene	6,780		1.1	
Benzo(a)pyrene	6,380		1.3	
Benzo(b)fluoranthene	1,030		1.5	
Dibenzo(a,h)anthracene	180		0.2	
Fluoranthene	2,540		3,100	
Fluorene	33		3,100	
Indeno(1,2,3,-cd)pyrene	920		0.86	

Answers: Soil Contamination

One ppm is the same as 1,000 ppb, and one mg/kg is the same as 1,000 µg/kg. In soil, mg/kg is the same as ppm, and µg/kg is the same as ppb.



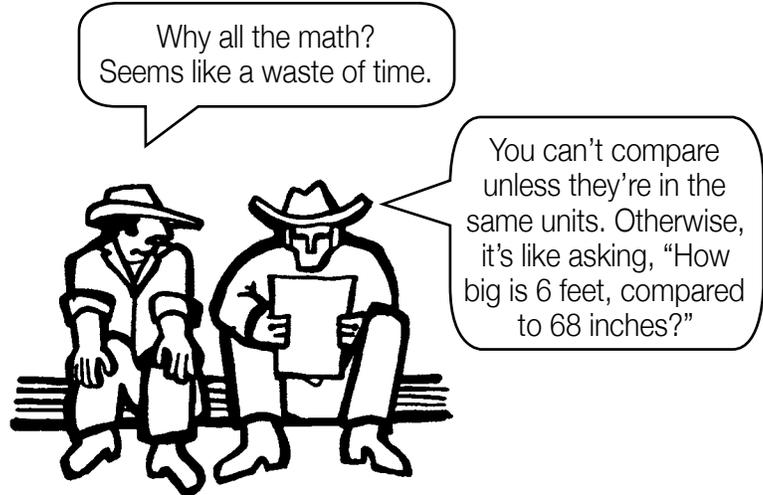
Directions

1. The sample results use different units from the state screening levels. Convert the sample results to the same units as the screening levels, and write them in the table below.
2. Then, just to be sure, convert the screening levels to the same units as the sample results.
3. Compare the sample results in mg/kg with the screening levels in mg/kg. Which sample results are higher than the screening levels? Circle them.
4. Now check your work: Compare the sample results in ppb with the screening levels in ppb. Which sample results are higher than the screening levels? Do they match with the ones you already circled?

Contaminant	Sample Results (in ppb)	Sample Results in mg/kg	Soil Screening Levels Residential Standards*	
			in mg/kg	In ppb
Benzo(a)anthracene	6,780	6.78	1.1	1,100
Benzo(a)pyrene	6,380	6.38	1.3	1,300
Benzo(b)fluoranthene	1,030	1.03	1.5	1,500
Dibenzo(a,h)anthracene	280	0.28	0.2	200
Fluoranthene	2,540	2.54	3,100	3,100,000
Fluorene	33	0.033	3,100	3,100,000
Indeno(1,2,3,-cd)pyrene	920	0.92	0.86	860

Water Contamination

One ppm is the same as 1,000 ppb, and one mg/L is the same as 1,000 µg/L. In water, mg/L is the same as ppm, and µg/L is the same as ppb.



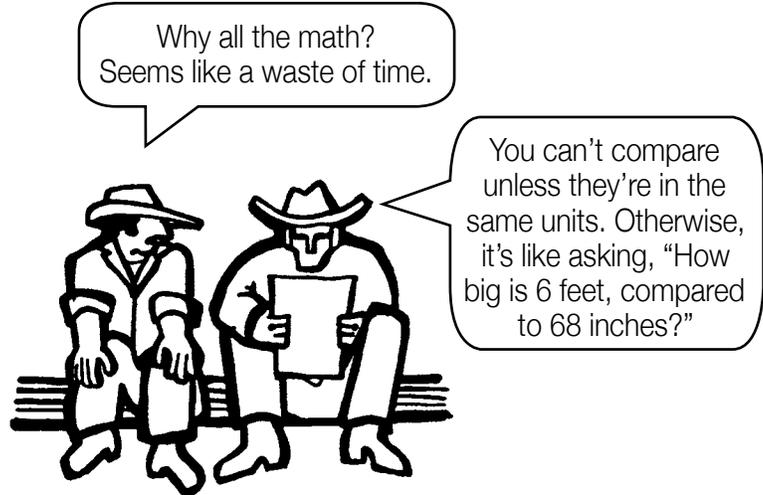
Directions

1. The sample results use different units from the state water standards. Convert the sample results to the same units as the standards, and write them in the table below.
2. Then, just to be sure, convert the water standards to the same units as the sample results.
3. Compare the sample results in mg/L with the water standards in mg/L. Which sample results are higher than the standards? Circle them.
4. Now check your work: Compare the sample results in ppb with the water standards in ppb. Which sample results are higher than the standards? Do they match with the ones you already circled?

Contaminant	Sample Results (in µg/L)	Sample Results in ppm	State water standards	
			in ppm	In µg/L
Benzo(a)anthracene	6,780		1.1	
Benzo(a)pyrene	6,380		1.3	
Benzo(b)fluoranthene	1,030		1.5	
Dibenzo(a,h)anthracene	180		0.2	
Fluoranthene	2,540		3,100	
Fluorene	33		3,100	
Indeno(1,2,3,-cd)pyrene	920		0.86	

Answers: Water Contamination

One ppm is the same as 1,000 ppb, and one mg/L is the same as 1,000 µg/L. In water, mg/L is the same as ppm, and µg/L is the same as ppb.



Directions

1. The sample results use different units from the state water standards. Convert the sample results to the same units as the standards, and write them in the table below.
2. Then, just to be sure, convert the water standards to the same units as the sample results.
3. Compare the sample results in mg/L with the water standards in mg/L. Which sample results are higher than the standards? Circle them.
4. Now check your work: Compare the sample results in ppb with the water standards in ppb. Which sample results are higher than the standards? Do they match with the ones you already circled?

Contaminant	Sample Results (in µg/L)	Sample Results in ppm	State water standards	
			in ppm	In µg/L
Benzo(a)anthracene	6,780	6.78	1.1	1,100
Benzo(a)pyrene	6,380	6.38	1.3	1,300
Benzo(b)fluoranthene	1,030	1.03	1.5	1,500
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