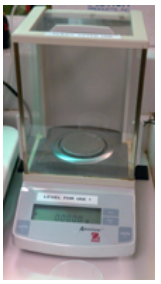

# Evaporation Extrapolation

By Eric Muller

Figure out the evaporation rate in a cup of water.
Then estimate the total evaporation rate of a nearby fresh water body such as a lake or reservoir by extrapolating your data.

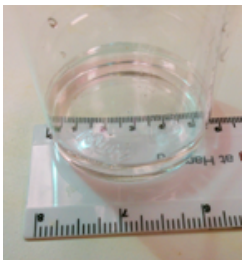


Materials:

- Scientific/analytical scale or balance that is accurate to at least a milligram
- Optional: `
  - A microgram would be even better
  - A glass enclosure would be advisable too
- Cup – lightweight (paper or plastic)
- Tap or freshwater
- Stopwatch

To do and notice:

1. Zero out your balance.
2. Pour a few grams of water into your cup
3. Measure the diameter of the water in your cup.
4. Note the diameter of the water in the cup here: _____ cm
5. Place the cup of water into the scale.
6. Note the mass of the water here: _____g (starting mass)
7. Start your stopwatch and time for 1 to 10 minute.
8. How many minutes did you time: _____minutes
9. Convert minutes to seconds: _____seconds
10. Note the mass of the water after timing here: _____g (final mass)



11. Calculate the rate of evaporation in the cup of water:


a. Staring mass – final mass = change in mass

_____g _____g _____g

b. Rate in cup = change in mass / total seconds (step 9): _____g/s

12. Radius of the water in the cup: Diameter / 2 = _____cm

13. Total surface area of water in the cup: πr^2 = _____cm^2

14. Evaporation rate per cm^2 in your cup:
Rate from step 11b / area from step 13 = _____g/s*cm^2

<u>Extrapolating your data to a larger body of water.</u>

A. Choose a local body of water and assume conditions at this location are the same as in your classroom (or where your analytical balance is located).

B. Almost all significant lakes and reservoirs have a recorded surface area. Search the Internet for this information. If you can't find your information, use this opportunity to estimate area using a mapping or "satellite viewing" web site such as Google maps or a GIS program to get this information.

Crystal Springs Reservoir near San Francisco has a surface area of 1,323 acres (535 ha)

C. Write the name of your chosen body of fresh water here:

_____

D. Total surface area of your body of water:

_____ (usually in acres, hectares, sq. feet or sq. meters)

E. Convert the body of water's total surface area into cm^2:

_____cm^2

F. Using your calculated evaporation rate per cm^2 in step 12, find the estimated total evaporation per second from your body of water:
Step 12 rate x Area in step E. = _____ g

G. Convert gram in step F. to kilograms.

Divide step F by 1000: _____kg per second

H. Since the density of fresh water is 1, your answer from step G. is also the number of liters per second: _____liters per second.

Note: Evaporation is based on many factors such as:
Humidity, temperature, airflow, air pressure and impurities in the water
In this activity, you are ignoring all these factors. You are just using data from a cup of water to make a good estimate of what's going on around you.

What's going on?:
Evaporation is a surface phenomenon of liquids such as water. When a molecule of water near the surface has enough energy, it will leave the surface and go into the atmosphere.
The amazing thing about a good analytical scale, especially one that registers to several digits, is that you can see the mass loss in a very short period of time…. like in the course of a few seconds or even in fractions of a second (we used a scale that registers to .0001g).

Extrapolating your data to large bodies of water shows that evaporation causes a loss of water to the atmosphere at an astonishing rate. Usually, your calculations underestimate the loss, by a significant amount too!

Reference:
http://en.wikipedia.org/wiki/Evaporation

Local reservoir: Crystal Springs
http://en.wikipedia.org/wiki/Crystal_Springs_Reservoir