THE AMERICAN SOUTHWEST: ARE WE RUNNING DRY?
COLORADO RIVER BASIN

Activity 3a
Salinity

The Colorado River is naturally salty as it picks up salts along with other sediments from the geosphere around it as the river flows downstream. Irrigating cropland increases salt in the runoff because it picks up additional salt from the land as it passes through the soil to the groundwater basins. This groundwater makes its way back to the river with more salt than it had before irrigating crops.

Any salt in water is called *salinity*. Merriam-Webster's Medical Dictionary defines salinity as "the quality or state of being saline" or more simply, being salty. In this activity the students will measure salinity levels and test the effects of salt on plants.

Essential Questions: What effect does increased salinity of river water have on the environment along that river? Who and/or what is responsible for the salinity of the river water? Can we control the salinity of the Colorado River? At what point must the salinity of the river water be controlled? What are ecologically friendly and/or economically feasible ways to control the salinity of the river's water?

Block 1

Objectives:

- Students will define *salinity*.
- Students will construct and calibrate a hydrometer.
- Students will use the hydrometer to determine the salinity of water.

Materials:

- Prior to activity, teacher will need to prepare the solution of saltwater. Measure 42 g of salt into a 1-L beaker or container. Add 1-L of pure water. Adjust solution until, using a universal hydrometer, you get a 42 ppt reading.
- Large plastic drinking straws plugged at one end with hot glue. Clay or plasticine may also be used.
- Sand
- Pure water
- 1-liter beaker for each small group. Clear plastic containers of a similar size may be substituted.
- Fine point black waterproof markers.
- Fine point red waterproof markers.

Procedure:

1. Fill the plugged straw about $^{1}/_{8}$ full with dry sand.

2. Fill an empty beaker or clear container with pure water (approx. ¾ full).

3. Gently put the straw into the beaker. It should float upright. Be careful not to allow water into the top of the straw.

4. Carefully observe the straw. It should float so that half is below water and half above water. If it's floating too high, carefully add sand. If it's floating too low, carefully empty some of the sand. Again, be careful to keep the sand dry.

5. Draw a black line on the straw to mark the water line to indicate the specific gravity of pure water. Label that line 1.00 also in black.

6. Now fill a beaker or clear container with the saltwater solution prepared by your teacher.

7. Gently place your calibrated straw into the second beaker or clear container. The straw should float upright.

8. Observe your hydrometer and where the water line is. Is it above 1.0, about 1.0, or is it below 1.0? Mark this water line with your red marker and label it 1.03. This indicates the specific gravity of water with a salinity of 42 ppt. Make two additional lines at equal gradations between these two lines, labeling them 1.01 and 1.02. Your hydrometer is now complete!

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Activity 3b
Salinity

Block 2
Objectives:
- Students will recall the definition of salinity
- Students will use their hydrometers to measure the specific gravity of solutions.
- Students will use conversion charts to determine salinity.
- Students will observe the effects of water with varying salinity levels on plants.
- Students will document the effects using photographs.

Materials:
- Prior to activity, teacher will need to prepare three saltwater solutions. For the first solution measure 42 g of salt into a 1-L beaker or container. Add 1-L of pure water. Adjust solution until, using a universal hydrometer, you get a reading of 42 ppt. The second solution should have 29 g of salt in 1-L pure water. The third solution should have 15 g of salt in 1-L pure water.
- Calibrated hydrometers made by students.
- Conversion charts showing Specific Gravity/Salinity of water, and Water Sources/Salinity.
- Set up stations with water samples of pure water and each of the saltwater solutions.
- 4 healthy plants.

Procedures:
1. Allow the students to move through the stations to measure the specific gravity of each water sample.

2. Using the data collected, label each water sample.

3. Distribute the conversions charts, or display on board or overhead.

4. Discuss where each water sample may have come from. Add this information to the labels.

5. Lead a class discussion to generate hypotheses about what might happen if each plant was watered with one of the solutions. Record and post these hypotheses.

6. Label each plant to correspond with a water sample.

7. Using a digital camera, take a picture of each plant. Display these as Day One.

8. Water each plant as needed with the water sample corresponding to its label.

9. Over the next 2 weeks continue watering as appropriate and document the health of each plant by taking a photograph each day.

10. At the end of 2 weeks revisit the hypotheses.

Conversion Chart

Specific Gravity	Salinity (ppt)
< 1.00	0 - 2
1.00	2
1.01	15
1.02	29
1.03	42

Salinity Baselines Chart

Water Type	Salinity (ppt)
Freshwater	<1
Intermediate water	1 – 3
Brackish water	3 – 18
Salt water/Ocean	>18