



Grade Level:
11th Grade

Subject:
Chemistry

Exhibit:
#9 Desalination
(Separating Solutions
and Mixtures)

**Approximate
Time Frame:**
2 hours (more than one
class period)

Materials:

- water
- sand
- salt
- vegetable oil
- beaker
- metric balance and weighing paper
- graduated cylinder

Lesson Plan - "Mix and Move"



Science TEKS:

1. A Demonstrate safe practices during field and laboratory investigations.
1. B Make wise choices in the use and conservation of resources and the disposal or recycling of materials.
2. A Plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology.
2. B Collect data and make measurements with precision.
2. C Organize, analyze, evaluate, make inferences, and predict trends from data; and
2. D Communicate valid conclusions.
3. A Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.
3. C Evaluate the impact of research on scientific thought, society, and the environment.
3. D Describe the connection between biology and future careers.
3. E Evaluate models according to their adequacy in representing biological objects or events.
4. B Investigate and identify cellular processes including homeostasis, permeability, energy production, transportation of molecules, disposal of wastes, function of cellular parts, and synthesis of new molecules.
11. A Identify and describe the relationships between internal feedback mechanisms in the maintenance of homeostasis.
12. C Compare variations, tolerances, and adaptations of plants and animals in different biomes.
12. D Identify and illustrate that long-term survival of species is dependent on a resource base that may be limited.



Related TEKS: Environmental Science

Vocabulary of Instruction:

brackish water,	concentrate
nano-parts	osmosis
electro conductivity	solution

Advanced Preparation: Organize students' into groups and perform a desalination project, model, or experiment. Discuss how the bi-product is managed.

Instructional Procedure (5 E)

Engage: The students will understand the reverse osmosis filtration system and compare it with other desalination processes. Discuss the pros and cons of each desalination process. Students may refer to the "Water from Water" PowerPoint at tech2o.org and/or use other internet resources.

Explore: At no time during this lab should students taste the water! Use all safety procedures when heating the solutions. In this lab we will try to separate a mixture of water with sand, salt and vegetable oil mixed within the water. The goal is to separate as much of the mixture that is originally mixed at the beginning of the lab.

Measure 50 ml of water and pour it into a beaker. Use a metric balance and weighing paper to mass out 5 grams of salt and 5 grams of sand and mix these with the water in the beaker. Next pour 5 ml of vegetable oil into the water.

You can allow the students the opportunity to determine the order of how to separate the mixture and the techniques they will use to end up with the same amount of water and the substances originally mixed in the water. If you let the mixture settle for a while the oil will float on top and you can use an eye dropper to suck out the oil. Collect the oil in a graduated cylinder to measure the amount you retrieve.

Next design a filtering system made of filtering paper and a funnel. Pour the remaining mixture of sand, salt and water through the filter and collect the filtrate in another beaker. Most of the sand will be trapped in the filter paper. Dry the paper and the sand to weigh later.

The remaining solution of salt and water can be separated using an evaporation system. A distillation tube can be used then you can collect the water much easier after it boils off as steam. This is just a tube within a tube. The inner tube collects the steam while the outer tube has water around the inner tube to cool the steam in the inner tube. As the steam condenses in the inner tube it is collected as water. The remaining solute should be the salt originally mixed in the water.

The idea for this lab is to collect the same amount of substances you originally mixed with the clean water. If you can get close to the same amounts



What
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solvent?

back from the mixture back then that is pretty good. This lab will help students understand some of the difficulties that come with desalination and water purification processes that the water company goes through to bring El Paso clean water.

Explain: Brackish water is a heterogeneous mixture made from a combination of water with a variety of substances mixed within. Some of these substances are suspended solids while other substances are dissolved within the liquid and in solution. The different kinds of matter in a mixture can be separated by physical means without causing any chemical changes. The substances that are insoluble in the solid phase can be separated by settling out the largest and most dense particles of the mixture and the smaller particles can be filtered out. Liquids that are insoluble in water will separate themselves if not stirred up using the buoyancy forces of different densities. After separating the insoluble substances the soluble substances must be separated that create the remaining homogeneous solution. Without the use of high tech selectively permeable membranes we can separate the remaining solution through a distillation process.

Elaborate/Extend:

Questions:

What is the difference between a mixture and a solvent?

What were the parts of the brackish water that were in solution and were not in solution?

What were some of the difficulties involved with separating the brackish water solution?

Did your final solution look like clean water?

What was your percent (error) in collecting all of the substances you originally mixed with the water?

Explain how a semi-permeable membrane selective for water would help the process of cleaning the water. During which step would using this membrane would be the best?

Evaluate: Closure of class will consist of student groups developing and presenting a statement about what they learned today and how it may change their ideas about water availability in El Paso. How much will you be willing to pay for fresh water?