OIMB GK12 CURRICULUM

3rd Grade **60 minutes**
(or divide into 2 separate lessons, osmosis and plant observations)

SALT MARSH PLANTS: Osmosis and Observations

Oregon Science Content Standards:
3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.
3.2 Interaction and Change: Living and non-living things interact with energy and forces.
3.3 Scientific Inquiry: Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

Ocean Literacy Principles:
4. The ocean makes the Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.

Goals:
- Introduce and demonstrate the concept of osmosis
- Practice making predictions, observations and conclusions in a short experiment
- Relate information and experiment to salt marsh plant stressors and adaptations

Concepts:
- Water molecules can move into and out of cells.
- Osmosis: water molecules moves from areas with less salt to areas with more salt.
- Semi-permeable means tiny things like water molecules can pass through, but bigger things like salt molecules cannot.
- Scientists use experiments to learn about the world around them.
- Salt marsh plants have adaptations to live in salty water.
- Salt marsh plants can be identified by the shape, color and size of their leaves.

Materials:
- 2 zip lock bags (more if you want more celery experiment examples to pass around to students)
- 2 stalks of celery (more if setting up more examples)
- Red and blue food coloring

- Potato slices cut into thin slices (2 per student group, best if each group's pair of slices are approximately equal in size and weight. Store in fridge in bag of fresh water)
- Cups, clear is best (2 per group)
- A gallon each of salty red water (add as much salt as will dissolve) and blue fresh water
- Scale (to weigh potato slices before and after experiment)
- Osmosis handouts (1 per student)
- Live salt marsh plant examples and/or PowerPoint
- Plant observations worksheet (1 per student)

Prep Twenty-four hour celery experiment to show students:

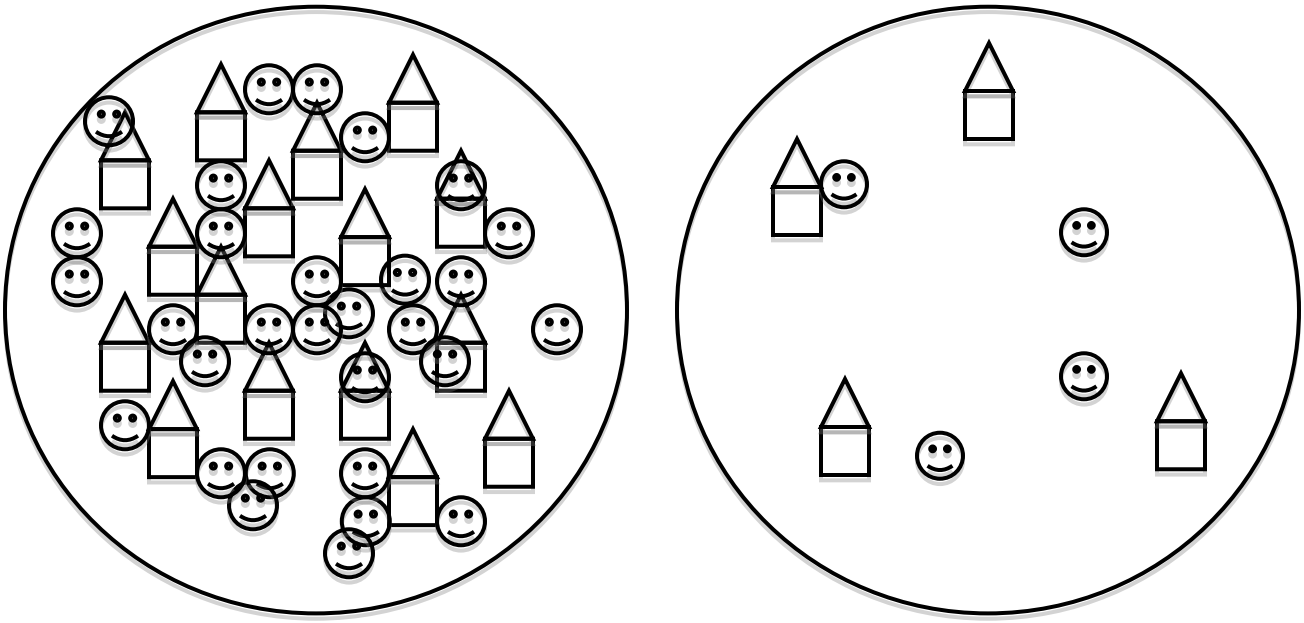
- Put a celery stick in a zip lock bag of salty water dyed red and labeled 'Salty'. Put another equally sized celery stick in a bag of fresh water dyed blue and labeled 'Fresh'.
- Best to let sit for 24 hours. The celery in salt water should be bendy and the celery in fresh water should be rigid.

Tips:

- Celery works well for the overnight experiment. It does not change much in the short time of the class lesson. Thin potato slices work better for in-class student experiments as they become bendy or rigid more quickly than celery.
- The thinner the potato slices, the faster students will see results.
- Saltier salt water helps speed up the experiment.
- Use similar sized potato slices so students can compare them more easily.

Lesson plan:

1. Review the definition of an estuary (*where the river meets the sea*) and the 4 zones of the estuary (*upland, high marsh, low marsh and mudflat*).
   In what zones are plants found? (*Upland, High Marsh and Low marsh)*
   Do land plants like salt water? (*No, they shrivel up*)
   Salt marsh plants are special kinds of plants that can live in salt water. We are going to learn about some adaptations these plants have that allow them to live in salt marshes.
2. Introduce osmosis using a trick-or-treat analogy:
   Draw 2 circles on the board and label them as two neighborhoods. Add a few houses to one and many houses to another. Where would students rather trick-or-treat? (The *neighborhood with more houses!)*
   Have the students imagine that the people are water molecules and the houses are salt.



neighborhood 1 neighborhood 2

house= salt
people= water molecules

Tell the students that just as they want to go to places with more houses for trick-or-treating, water molecules want to go to places with more salt.

3. Write on board: **Osmosis - water wants to go from places with less salt to places with more salt**
4. Explain the concept of osmosis.
    - That all living cells have salts in them and that these salts are trapped by the membrane of the cell.
    - That water can cross this semi-permeable membrane—the salt molecules are too large; this movement of water is called osmosis.
    - That water will move into or out of cells based on where there are more salts.
5. Draw more examples and have the students say if water will move in or out of the cell.
6. Discuss the overnight celery experiment (see 'prep'). Pass around the celery in bags so students can feel the difference between the rigid celery and bendy celery. Make sure the two bags are labeled as salty and fresh *and* dyed salty=red and fresh=blue. Explain that more water in a cell makes it firmer (just like a water balloon). If the stalk is bendy, do the cells have more or less water in them than the cells in the stiff stalk? Where did the water go? *(It moved from the celery*

cells with a low concentration of salt to the higher concentration of salt in the salt water).

7. Introduce the potato experiment the students will do in class: thinly sliced potatoes will be placed in a cups of salt water and cups of fresh water and the students will compare what happens to the potato slices.
8. Review osmosis in context of today's potato experiment *(Water wants to go from places with less salt to places with more salt. Potatoes have some natural salts within their cells):*
    - *The potato has less salt than the salty water so the water will want to go from the potato into the water—that will make the potato limp and bendy, and since it will lose water, it will lose weight.*
    - *The potato has more salt than the fresh water so the water molecules will want to go from the fresh water into the potato—that will make the potato crisp and gain weight*.

    Make sure students can explain why they would expect a potato in one cup to be heavier and stiffer than the other cup.
9. Have students draw the experimental set-up, and circle their predictions (see key).
10. Pass out cups and potato slices (best if each group gets two potato slices that are approximately equal in size and weight).
11. Have the students observe and weigh their potato slices and record the weights before putting them in the water.
12. Have the students label cups for each group with an F for fresh water or S for salty as you add the water. The students then gently place one potato slice in each cup. They will need to wait about 10 minutes.
13. While waiting, show examples of salt marsh plants (real or PowerPoint). If you have real plants, have students look for salt crystals on the tips or the branch point of the plants, salty crust on leaves, feel for a waxy coating, etc.

    Briefly explain some ways plants deal with growing in salty areas:
    - Some plants have blockers that keep salt from coming in through their roots or stems
    - Some plants take in salty water and secrete (get rid of) the salt through their leaves
    - Some have a waxy coating to prevent water loss due to osmosis
    - Some have places to store water inside them (e.g. pickleweed)
    - Some grasses roll their leaves into tubes to prevent evaporation water loss

    Have students draw observations of the plants and their adaptations.
14. Go back to the experiment. Have students make observations about their experiment and draw their observations on the worksheet.
15. Have the students weigh their potato spears and fill in their data chart and circle their results on their worksheet.

16. As a class, discuss the answers on the worksheet and review what happened to both the celery and potatoes: water moved **into** the celery and potatoes placed in fresh water, and **out of** the celery and potatoes placed in salt water. Water molecules moved from areas of low salt to high salt concentration. This process is called osmosis.
17. Based on what they just learned, why is it is tough for plants to live in salty water? *(Regular plants in salty water would lose water and become bendy; they wouldn't absorb the water they need to live and grow. Salt marsh plants have adaptations to retain water and get rid of salt.)*

Assessment: Worksheet, participation and discussion.

Source: Adapted from Janice VanCleave. 1996. *Limp Spuds*, pg. 36, 202 Oozing, Bubbling, Dripping & Bouncing Experiments. John Wiley & Sons, Inc.

GK12 Fellows: Tracey Smart, Erin Morgan, Kira Treibergs and Kristina Sawyer

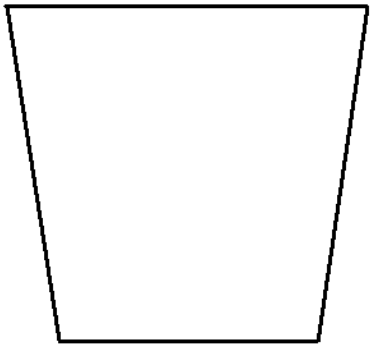
Name_____

OSMOSIS!

Osmo the water molecule is taking a trip.
Where will he go?

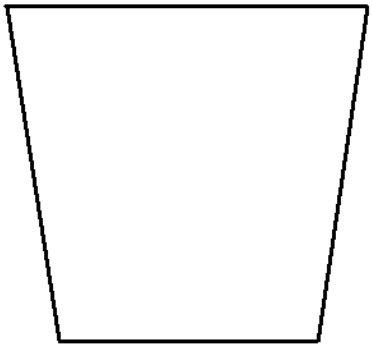
Draw the set up of your experiment (draw where you'll put water and potato slice.)

Fresh Water



CUP

Salt Water



CUP

PREDICTION

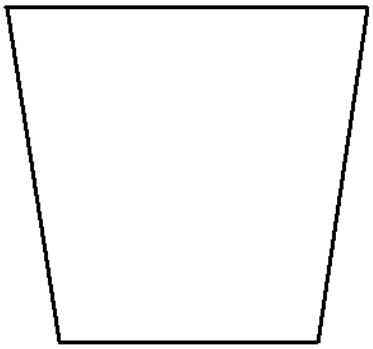
I predict the potato in the **FRESH** water will **lose gain** weight.
(Circle your **prediction**.)

I predict the potato in the **SALT** water will **lose gain** weight.
(Circle your **prediction**.)

OBSERVATIONS

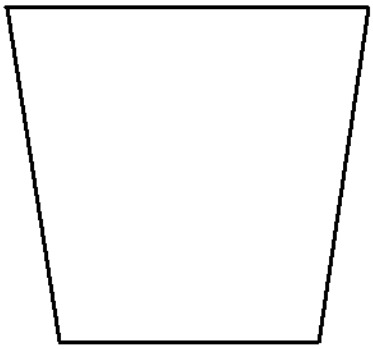
Draw your observations:

Fresh Water



CUP

Salt Water



CUP

Weight of Potato Slices

	In SALTY water	In FRESH water
BEFORE	_____ grams	_____grams
AFTER	_____ grams	_____ grams

RESULTS

The potato in the **FRESH** water **lost gained** weight. (Circle one.)

The potato in the **SALT** water **lost gained** weight. (Circle one.)

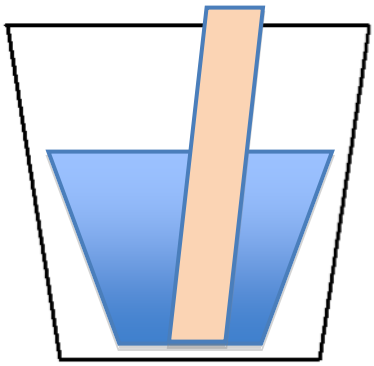
Name_____KEY_____

OSMOSIS!

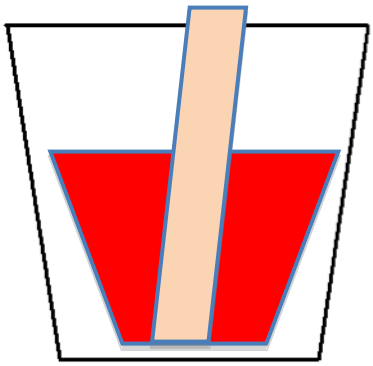
Osmo the water molecule is taking a trip.
Where will he go?

Draw the set up of your experiment.

Fresh Water



Salt Water



PREDICTION

I predict the potato in the **FRESH** water will **lose** **gain** weight.
(Circle your **prediction**.)

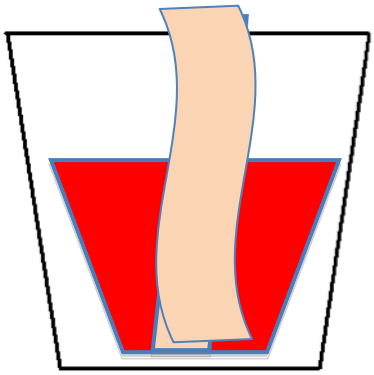
I predict the potato in the **SALT** water will **lose** **gain** weight.
(Circle your **prediction**.)

OBSERVATIONS

Draw your observations:

Fresh Water

Salt Water



Weight of Potato Spears

	In SALTY water	In FRESH water
BEFORE	_____ grams	_____grams
AFTER	_____ grams	_____ grams

RESULTS

The potato in the **FRESH** water **lost** **gained** weight. (Circle one.)

The potato in the **SALT** water **lost** **gained** weight. (Circle one.)

Salt Marsh Plants Name_____

Succulent: a plant that can store water
Sedge: a grass with leaves that have edges
Rush: a grass with round leaves

"sedges have edges, rushes are round"

Draw a picture of each plant and its adaptations, and write which plant type it is:

Plant name _____ Plant name _____

Plant type_____ Plant type_____

Plant name _____

Plant type_____

Plant name _____

Plant type_____

Plant name _____

Plant type_____

Plant name _____

Plant type_____