Grow Creatures
Integrating Science and Math

Grades: middle school

Science Standards: Content Standard A: Science as Inquiry; Content Standard B: Physical Science; Content Standard E: Science and Technology

Purpose: To observe and graph the growth of a polymer toy in water or other liquid.

Background: Grow creatures contain two polymers. One is hydrophilic or "water-loving" that causes the water to be absorbed into the creature when the toy is placed in water. The second polymer is hydrophobic or "water-hating" and this polymer forms a shape framework of the toy so that the creature maintains is shape as it grows.

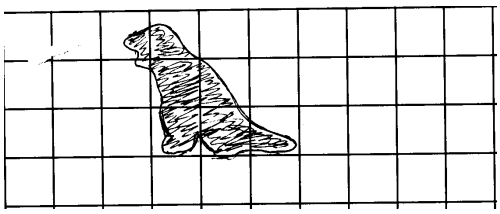
Hypothesis: If my Dino likes to grow in water (or other liquid_____), then I predict that my Dino will increase in size from 4 1/4 squares to _____ squares in one day.

Materials: for a team of students

1-Grow Dino or other grow creature (toy store, Discovery Store)
Small bowl or plastic container about 15 cm in diameter – labeled with team name
6 sheets of 1-centimeter graph paper (available on the Web at:
http://www.incompetech.com/beta/linedGraphPaper/graph.pdf
tap water, distilled water, or other liquid
paper towels
metric ruler
colored markers or pencils

Procedure:

1. Starting at the top of a sheet of graph paper, trace around the Dino. Shade or color in the shape. Count the number of full-shaded or colored squares. Place a large colored dot in the counted squares. Record this number on the graph paper next to the Dino shape. Now count the partially filled squares. Record the number of halves and fourths that are shaded. Record. Add all the whole numbers and fractions. Also record the time next to the total number of squares. See sample below:



Shaded Squares:
1/4+1/2+1/2+3/4+3/4+1+1/2=
4 1/4
Time: 9:00 am

2. Place the Dino is a container of water or other liquid. Make sure the Dino is covered with the liquid. Wait one hour or longer.
3. Remove the Dino and pat him dry with paper towels. Place the Dino on the same graph paper but below the first drawing. Trace, shade or color as you did before. Count the shaded squares and record. Record the time.
4. Put the Dino back into the water (or liquid) and wait for another hour. Repeat these steps for 24 hours or one day. You may record every few hours and still get good data.
5. After the last tracing, add ¼ cup of table salt to the water (or liquid) in the container that held the Dino. Stir to mix the salt into the water or liquid. Place the Dino into the salt solution. Notice that he floats! Place a spoon or other object on the Dino to keep the Dino under the salt solution. Wait for one hour and repeat measurements as you did before. Keep soaking and recording until the Dino reaches a size where there is no longer any change.

Conclusions:

1. Your data is the number of squares on your graph paper. Measure the size of a square in centimeters with a ruler. One square is equal to _____ square centimeter. This is a measurement of area or length x width.

2. How many square centimeters did your Dino grow in water in one day? _____

3. Using the data of size in square centimeters and time, make a line or bar graph to show the changes in area per hour for the WATER OR OTHER LIQUID measurements. The time is the independent variable and placed on the horizontal axis.

4. Make another graph of the salt solution measurements.

5. Did you prove your hypothesis correct? ____ Explain. _____

_____

_____

6. How did the growth of Dino compare to the observations you made while he was in a salt solution? Did he behave the same or differently? Explain.

_____

_____

_____

7. Based on your observations, explain the movement of water for the Dino in water and for the Dino in salt water. Answer on a separate sheet of paper.

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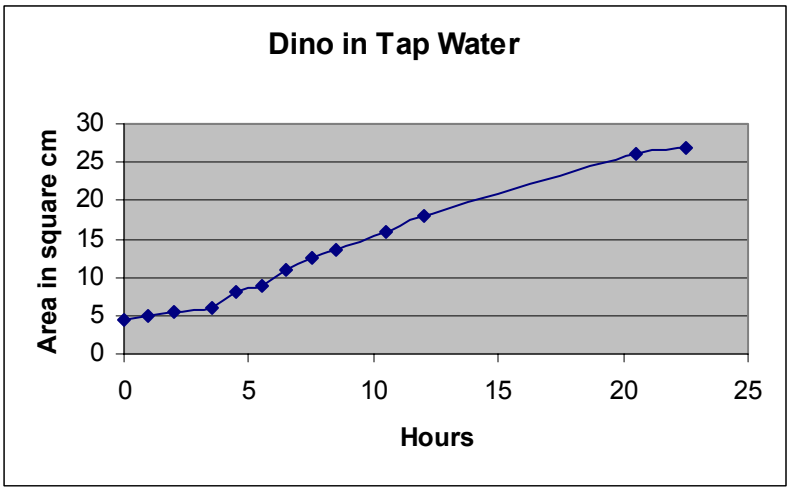
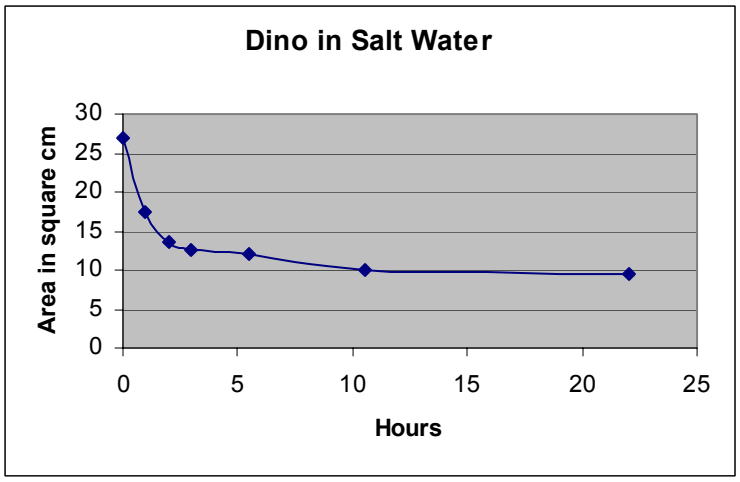
Teacher Notes

Changes in the procedure to fit your classroom:
1. Measuring in length instead of area is also possible. Students use a metric ruler to measure the centimeters in length on each shaded Dino.
2. Instead of drawing line or bar graphs, using lengths of string to correspond to the length of each growth period is a visual way to show growth. Place the strings on a bulletin board graph.
3. Grow creatures come in all sizes. Small ones grow from 3 cm to 7 cm. Large alligators grow from 3 in to 18.5 in. and take 7 days to grow. Really large "brains or hearts" grow to huge sizes.
4. If you have a balance in your room, it is also possible to measure mass as well as area.
5. You may choose to shrink the Dino in air. Water will evaporate from the creature over time. This is slower than using salt water.
6. Salt water that might be splashed into eyes is a safety concern. Safety glasses may be worn for the second experiment.

Explanation: Water is attracted to the hydrophilic polymer and so it enters the grow creature and is held in place by the framework polymer. Salt water causes the reverse reaction by causing the water to leave the polymer framework back into the salt solution. Water likes to move from high concentration of water to low concentration of water. Water will move into the polymer (low concentration of water) first. Then when the polymer is filled with water (high concentration), the water will move into the salt solution (low concentration of water) in the second experiment. The same principle works for water movement in cells and plants.

Sample Data:





Extensions:

"Growing Gators" by *Teaching Physical Science through Children's Literature* is on the Web at:
http://www.terrificscience.org/freeresources/presentations/ncw/GrowingGators.pdf
This uses *Zach's Alligator* by Shirley Mozelle, Harper Collins, 0-06-44186-5. Zach soaks his alligator keychain in water…
The toy alligator is available from Educational Innovations #GB-2:
http://www.teachersource.com for $1.95 and will start at 3 inches and grow to over a foot long.
Zach's Alligator Goes to School, by Shirley Mozelle is also available from Educational Innovations BK-206 for $3.95 (My colleagues highly recommend this book.)

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Polymer Ambassador Web Site: www.polymerambassadors.org