Name: _____Date: _____Period: _____

WHERE'S THE BEACH?

Session 2, Explore: Wave Simulation Experiment

Directions: Use the diagram here as a guide to build your device and follow the instructions below to simulate wave action in three different conditions.

Materials:

- Concrete paver or paving brick (1" thick)
- Pebbles
- Sand
- Lego® pieces or other blocks
- Large shallow container or tub with long sides (or stream table)
- Water
- Wooden board - same width as container (Part 2 only)
- Marker pen (Part 2 only)
- Ruler (Part 2 only)
- Timer (optional)
- Digital or video camera (optional)
- Gloves (optional)
- Waterproof apron (optional)

Construct a Wave Device

1. Be sure to thoroughly wet the sand provided before adding to your clear tub.

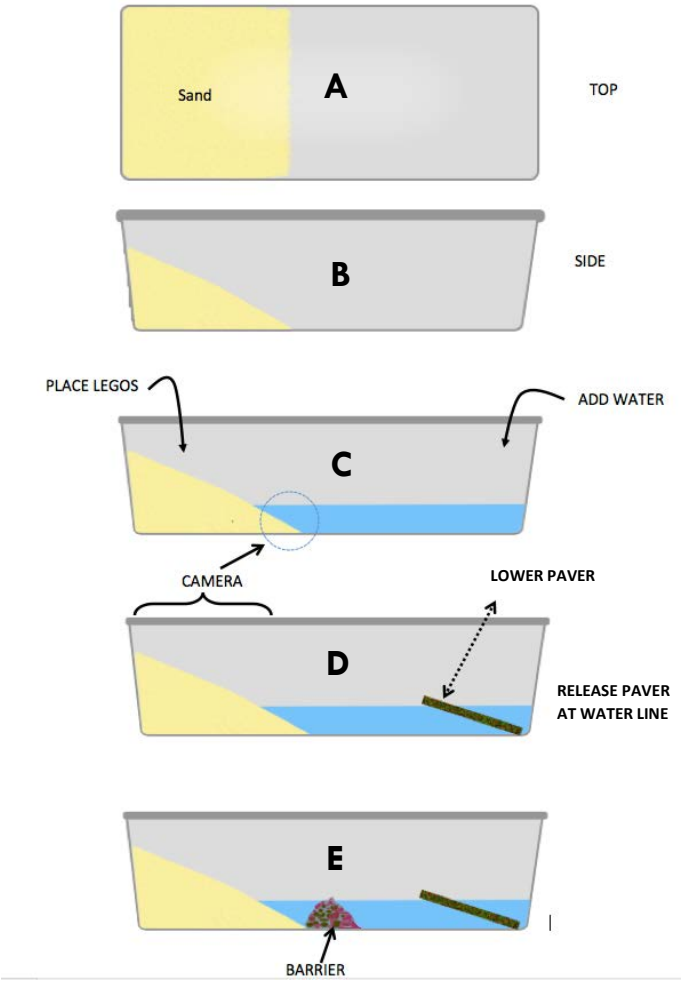
2. Add enough sand to one end of the tub to come about half way up the side of the tub and about half way along the length of the tub (image A).

3. Carefully add water to the tub. Try to disturb the sand as little as possible. Add enough water to cover about 1/3 of the width of your sand "beach" (image B).

4. Place the Lego® pieces on the sand at various distances from the "shore" (image C). These will represent the "built environment".

5. *(Optional)* If digital or video camera is available, photograph your set-up from the top so you have a birds-eye view of the tub. Place the video camera on the side of the box so that you can document wave action. Be sure to start the video camera before each investigation (images C and D).

6. Follow the instructions for creating a barrier on the next page (image E).



Part 1: Wave Simulation Experiment

You will conduct three investigations to demonstrate the extent of erosion without a barrier, with a narrow barrier (to simulate a small oyster reef), and with a wide barrier (to simulate a more extensive oyster reef).

Tub set-up for each experiment:

- Condition 1 (no barrier): Use the set-up as is, do not add a barrier.
- Condition 2 (narrow barrier): Use pebbles to simulate the reef. Place the "reef" in front of the sand for the second trial.
- Condition 3 (wide barrier): Add more pebbles to make the reef wider.

1. Use the following instructions to test each condition. Record your observations on page one of the data table.

2. To create a wave in the tub, place the paver on its edge and lower it toward the water. Just before it is immersed in the water drop the paver the last height (the depth of the water). This will create a wave. **Do not let go of the paver until it is at the waterline**. If you drop it far above the waterline, it will create a splash, and this is not the desired effect.

3. Observe the effect of the wave and record your observations. Was there erosion? Did the Lego® pieces move around? Do this for each of the three conditions, being sure to "reset" the beach after each trial if there was any erosion.

4. Your teacher will assign your group one of the following additional experiments for each of the conditions:

    a. Vary the **height** from which you drop the paver to vary the strength of the wave. Experiment to see how high to drop the paver to start moving the sand around and "eroding" the beach.
    b. Vary the **total time** the paver is moved to simulate the duration of a storm.
    c. Vary the **depth of the water** in the tub to simulate different tide levels.

5. You will vary the height, time, or depth **three times** during your investigation, be sure to record these numbers at the top of the data table on page two. Conduct your investigations and then record observations on the data table. As before, be sure to reset the beach before the next round.

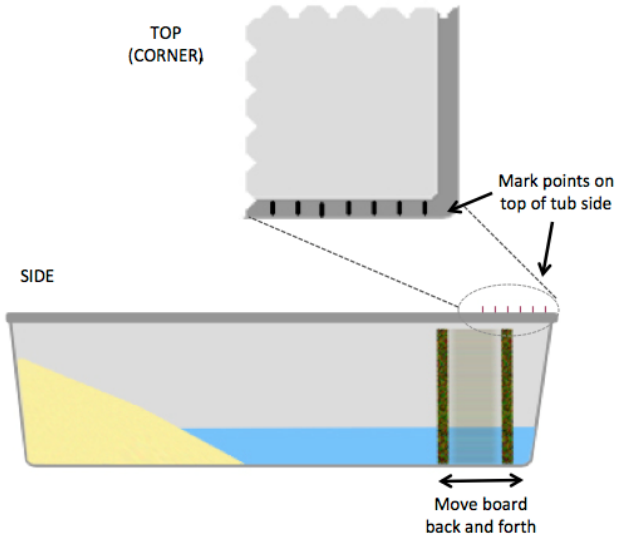
Part 2: (Optional) Continuous Waves Experiment
Compare the wave effects created by the paver with the effects of continuous waves created by board movement.

1. You will need to create your own data table for this experiment. Read through the steps below and determine the data you will be collecting.

2. Mark points with a marker pen along the top edge of the tub. Use the ruler to ensure the points are equally spaced.

3. Use a board about the same width as the tub to create a continuous wave motion. Use the points along the top edge to ensure waves are uniform. You will not need to move the board far to get significant waves.

4. Repeat the above step moving the board a greater distance or for longer times.



5. Record the distance you moved the board each time and write the corresponding observations on your data table.

<u>Wrap-up Questions:</u>

1. Which barriers were most effective in preventing beach erosion?

2. Discuss why barriers prevent erosion and how that relates to the concept of energy. What is the relationship between barrier size and wave size?

3. Given the results of your experiments, hypothesize on the relationship between barrier cost and size, and the wave energy such a barrier will protect against. What might be the limiting factors to implementing the most successful barriers?

4. Create a graph that depicts the relationship between barrier cost and size (y-axis), and the wave energy such a barrier will protect against (x-axis). Don't worry about the exact numbers, just depict the general idea of the relationship between these characteristics.