The Forces of Waves:
Disappearing Beaches Activity Sheet

Name: _____ **Date:** _____

Part A: Make a Beach Simulation Tank

1. Gather your materials to model beach erosion!
    a. Rectangular dish (e.g. tupperware container), Sand, Rocks of varying sizes, Water, Flat spatula, Food Coloring, Toothpicks, Markers (3 colors), Metronome, Ruler

2. Use the ruler to mark at each centimeter along the sides of your rectangular dish. This will help you measure beach erosion throughout the experiment.

3. Add enough sand to your dish that it covers the bottom. Push it all to one side to form a sloping beach.

4. Add water to your ocean model so that it covers the bottom of your dish and some of the sand.
Note: There should be a section of sand above the water line (about 2 inches).

5. Add a few drops of food coloring to your water so that it is easier to see.

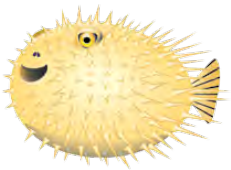
6. Reform your beach to ensure that:
    a. It has a uniform shape from side-to-side
    b. There is at least a 2 inch wide beach above the water

7. Use a permanent marker to trace the slope of your beach on the outside of your container. Draw a small mark where the water and sand meet. This is the **shoreline**.
Note: You will use this line to reform your beach in the same shape for each trial.

8. Mark the shoreline with toothpicks stuck in the sand.

9. Make a "before" sketch of the side view of the beach. This is the **beach profile**.
Note: you can use your ruler to take measurements of different parts of the beach.

My beach model: No wave erosion



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Part B: Practice Making Waves!

1. Use a metronome or sound recording (search metronome online) set at 60 beats per minute (or similar).

2. Put the large side of your paddle in the water the edge of your container on the opposite side of the beach. Start the metronome, and gently move the paddle towards the beach in time to the beat.

3. What did you see? Write your observations.

Part C: Test the Force of Waves

1. Reshape your beach so it lines up with your original profile line and the shoreline is in the same spot.

2. Follow the metronome sound and use the paddle to make a wave at each second for 2 minutes. *Note: Try to give each wave the same force with your paddle.*

3. After two minutes of making waves, observe the effect of wave force on sand movement.

4. Use a different color marker to trace the new line of the beach and mark the shoreline on the side of your container

5. Describe how your beach has changed.

6. Make an "after sketch" of the beach profile following the wave action.

My beach erosion model: Wave erosion

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Part D. Test a Sea Wall!

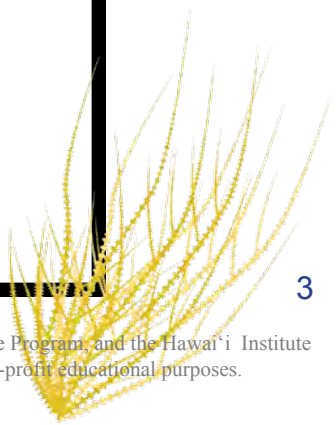
1. Reshape your beach again so that it lines up with your original profile line and shoreline.
2. Create a seawall by placing rocks at the shoreline (above the toothpicks).
3. Draw another "before" sketch of the beach profile.

My beach model: Seawall

4. Repeat part C to test the force of the waves against the seawall.
5. Describe how your beach and seawall has changed.

6. Make another "after sketch" of the beach profile following wave action with the presence of a seawall.

My erosion model: Wave erosion with a seawall



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Name: _____

You have just experimented with balanced and unbalanced forces!

- When two equal forces act in opposite directions, the forces are **balanced** and there is no motion.
- When one force is stronger than the other, the forces are **unbalanced** and lead to the motion of an object.

Use this information and your observations from your experiment to answer the following questions:

1. Imagine that two teams are playing tug-of-war on a rope.

   a. If their strength is equal and neither team is winning, are the forces balanced or unbalanced?

   b. If one team lets go, and the other team wins the rope, are the forces balanced or unbalanced?

2. Think back to when you first set up your beach:
   a. What would the beach profile look like the next day if you did nothing to it? (Hint: would the sand move by itself?)

   b. If you return the next day, and the **sand has not moved**, were the forces acting on the sand balanced or unbalanced?

   c. If you return the next day, and the **sand has moved**, were the forces acting on the sand balanced or unbalanced?

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3. What happened to your beach profile when there was wave action? Explain.

4. When waves interact with the shoreline to move sand, are the forces:

   a. **Balanced** or **Unbalanced** (Circle one)

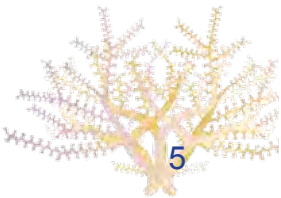
   b. What evidence do you have to support your answer?

5. Why do you think that people build rock walls (or other hard structures) at the beach?

6. After you added your rock wall, did waves affect the beach profile differently than before? Describe.

7. Based on your observations, can you think of a reason why beach scientists often recommend **against** building sea walls in line (or parallel) with the beach? (hint: look at the entire beach profile, from under the wall and into the water).

8. What other ways can people protect homes and property besides building seawalls parallel to the beach? (hint: think about how far property is built from the water, the amount of sand needed to protect property, the role of native plants in holding sand on a beach, and the various shapes and positions of seawalls compared to groins or piers.)



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