Name____________________________________

THE EFFECT OF WATER DEPTH ON WAVE SPEED

PURPOSE

To observe the effect that different water depths have on the speed of small man waves.

MATERIALS

Small aquarium Meter stick Stop watch cushion waterbucket marine biology book

PROCEDURE

1. Always keep the cushion under the lifting end of the aquarium.
2. Add 1 cm of water, using the water bucket.
3. Lift one end of the aquarium and rest it on the edge of the book.
4. Wait until all water movement has stopped.
5. Start the stopwatch at the same time that you pull the book out from under the aquarium. (hold in the cushion!)
6. Stop the watch at the instant the wave returns to the end of the aquarium AWAY from the book.
7. Record the time (period) in the appropriate space on your data sheet.
8. Repeat steps 3-7 two more times so you will have 3 readings for the same . Repeat steps 2-8 three more times so you will have taken

- 3 readings each for
- 4 different depths (1cm, 3cm, 5cm, 7cm)
- Calculate the average period for the four depths and record the results on the data sheet.
- For each depth, calculate and record the wave speed, using the average period. [Wave Speed = wave length / period] (wave length=length of aquarium)
- Graph your results using the water depth as the Y-axis (up and down) and using wave speed as the x-axis (across the bottom)

BE SURE TO LABEL the y-axis and x-axis and the title of the graph.

Part III

CONCLUSION

1. How did the depth of the water affect the speed of the wave?

2. Would you expect a wave to slow down or speed up as it reaches shallow water? What is causing this effect?

3. How might bottom friction in shallow water cause waves to spill over in the form of breakers?

Wave Problems

4. A beach ball rises and falls 20 times in 40 seconds. What is the frequency of the waves? (#/t)

5. In 60 seconds, 20 wave crests pass a dock pole. What is the wave period? (t/#)

6. A boat goes up and down 45 times in 15 seconds. What is the wave frequency?

7. 50 wave crests pass a buoy in one minute. What is the period of these waves?

Wave Length Water Depth Period Average period Wave speed

Data Tables **Name**__________________________**pd**____

Wave Length	Depth	Period	
		1	
		2	
		3	Avg.
		1	
		2	
		3	Avg.
		1	
		2	
		3	Avg.
		1	
		2	
		3	Avg.

Depth	Wave Speed [wave length/avg. period]

12.Graph

Ocean Currents

Ocean currents are important in many ways. Currents influence climate, marine shipping, and the distribution of fish and other marine life. Scientists use drift bottles and drift cards to measure ocean currents. The original drift bottles were simply glass bottles with a message in it and sealed with a cork. The plastic disks and other devices which have replaced them have engraved messages on it. The exercise below is a result of data from actual drift-bottle experiments done off the Oregon coast in

November 1970. The data given can be used to determine the speed and direction of the surface currents (along with some helpful formulas from me!).

As there are no fixed points in the ocean (at sea), we use <u>latitude</u> and <u>longitude</u> to tell us positions. These are imaginary lines dawn over the earths surface with the latitude lines evenly spaced to tell us the distance north or south of the equator (the imaginary line around the earth located halfway between the north and south poles), and longitude lines tell us the east and west distances (based on an imaginary line running through Greenwich, England).

Latitude and longitude are measured in <u>degrees</u>. Each degree is divided into sixty minutes and each minute is divided into sixty seconds.

1 degree = 60 minutes (1° = 60')
1 minute = 60 seconds (1' = 60")
1' (minute) = 1 nautical mile or 1.852 km
1 ° (degree) = 60 nautical miles or 111.12 km
1" (second) = 30.8m or 101 feet.
Equator to north pole = 90 °

<u>MATERIALS:</u>

ruler, pencil and supplied map.

<u>PROCEDURE:</u>

1. Use the supplied map of the Oregon coastline and the Drift Bottle Data Table below.
2. Use the Data Table to plot the courses of the bottles that were released. You can do this by locating the two points for each bottle: 1. the release point and the 2. point of return. These points can be located by using the latitude and longitude figures given in the Data Table.
3. As no visual observation of the drift bottles were made, we must assume (for this activity) that the bottles traveled in a straight line from the point of release to the point of return.
4. From the information you have plotted on your map, determine the total distance each bottle traveled in degrees. To do this ;
1. measure the length of the line from the point of release to point of recovery (the one you drew on the map).
2. Lay the ruler along the vertical axis (latitude) of your map and note how many degrees of latitude correspond to your measured distance. (a compass works easier)

5. Calculate the number of nautical miles traveled by each bottle. Remember 1 minute= 1 nautical mile and 60 minutes = 1 degree.
6. Add this information to your Data Sheet.
7. Compute the speed of each drift bottle in nautical miles per hour (knots). Remember there are 24 hours in a day and then add this to your Data Sheet.
Example: Bottle traveled 1 degree ° or 60 nautical miles (1 ° degree= 60 minutes and 1' minute = 1 nautical mile) in 5 days (24 hours x 5 = 120 hours) so bottle traveled 60 nautical miles in 120 hours or .5 knots or .5 nautical miles per hour. (60/120)

RESULTS AND INTERPRETATION:

1. Which bottle traveled the greatest distance?

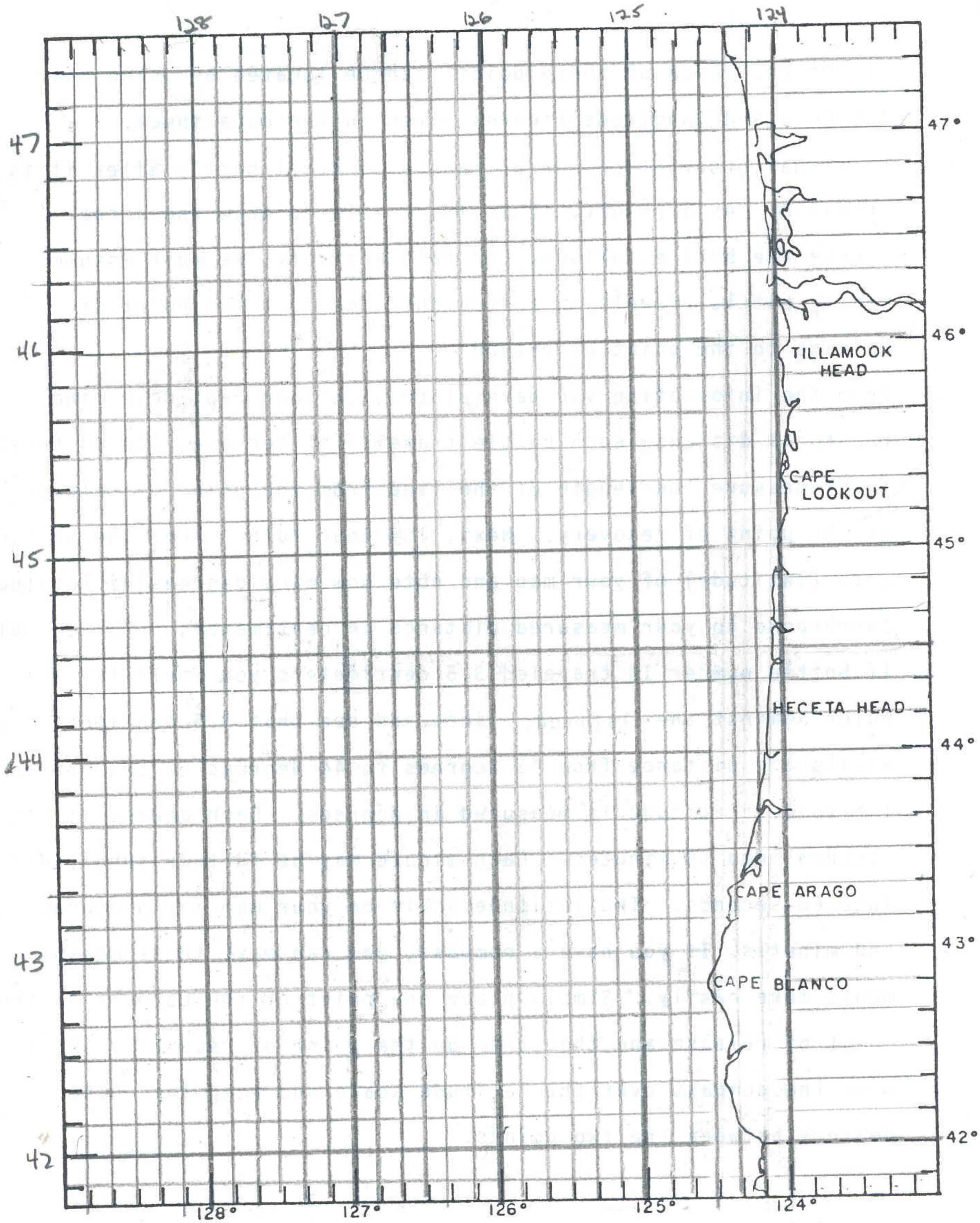
2. Which bottle had the slowest speed?

3. Which bottle made the greatest change in latitude?

4. Do all the currents off the Oregon Coast run in the same direction?

DRIFT BOTTLE DATA TABLE

Bottle No.	Release position Lat N	Release position Long W	Return position Lat N	Return position Long W	Distance traveled (nautical) miles	Days out	Velocity (knots)
1.	44.39'	124.11'	46.43'	124.06'	____________	22	____________
2.	44.39'	124.11'	45.32'	123.58'	____________	8	____________
3.	44.39'	124.25'	46.53'	124.08'	____________	13	____________
4.	44.39'	126.03'	46.03'	123.56'	____________	11	____________
5.	44.39'	126.59'	44.18'	124.06'	____________	51	____________
6.	44.39'	126.59'	43.43'	124.12'	____________	54	____________


128
127
126
125
124
47
46
45
44
43
42
47°
46°
45°
44°
43°
42°
TILLAMOOK HEAD
CAPE LOOKOUT
HECETA HEAD
CAPE ARAGO
CAPE BLANCO
128°
127°
126°
125°
124°

OCEAN CURRENTS II

Scientists believe that the ocean surface currents are caused by winds which prevail in that region. Below are the descriptions of some of the major ocean currents; use this information to label the currents on the map supplied.

1. The Gulf Stream Current in the Northern Hemisphere flows north along the eastern coast of the US in a clockwise direction, bringing warm water along its course.

2. In the Southern Hemisphere the Humboldt Current (Peru Current) travels north bringing cold water along the western coast of South America, traveling in a counterclockwise direction.

3. The Kuroshio Current (Japan Current), which is in the Northern Hemisphere, runs clockwise along the eastern coast of Japan bringing cool waters to the coast of California, where it becomes part of the California Current.

4. The West Wind Drift is a cold current traveling from west to east which circles Antarctica in the Southern Hemisphere.

5. The North Equatorial Current in the Pacific Ocean runs clockwise just above the equator in the Northern Hemisphere; it later joins the Kuroshio Current.

6. The South Equatorial Current in the Southern Hemisphere runs counterclockwise just below the equator.

7. The Equatorial Counter Current runs west to east between the North and South Equatorial Currents.

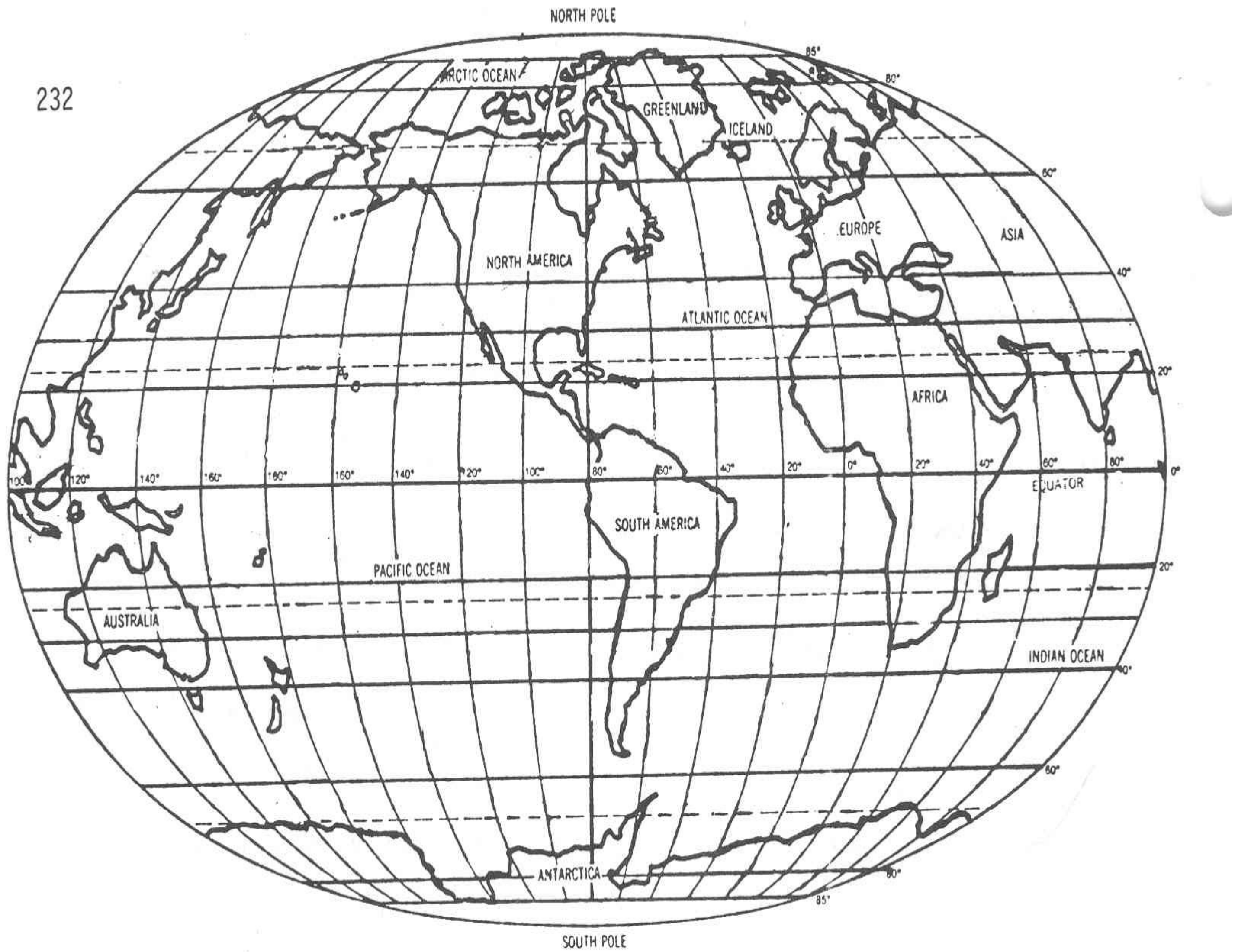
8. The Brazilian Current in the Southern Hemisphere runs counterclockwise along the coast of South America.

9. Running clockwise in the Northern Hemisphere, the California Current travels along the western coast of the US.

10. The Benguela Current runs counterclockwise along the west coast of Africa.

11. The Agulhas Current in the Southern Hemisphere travels counterclockwise along the east coast of Africa. It continues southward along the east and west coasts of Madagascar to the tip of Africa.

12. In the Northern Hemisphere the Labrador Current travels south bringing cold waters to the east coast of Canada. It intermingles and cools the warmer Gulf Stream Current in the North Atlantic.



TIDE ACTION ON THE BEACH

The tides cause the ocean waters to move up and down the beach. The slope of the beach and the height of the tides determine how much beach is subjected to this alternate wetting and drying. This motion and periodic wetting greatly limit the numbers of animals and plants that live in the intertidal zone. The plants and animals that live in areas affected by the tides have developed special ways to deal with their environment. In this activity you will have a chance to look at some changes that occur on the beach due to the tides.

Materials:

Beach slope cross section (overhead) pencil and straight edge.

Procedure:

Use the beach slope cross-section to answer the following questions...putting the answers on the answersheet section.

1. Use the vertical scale to determine the tide position of each marker, in feet, above or below zero tide.
2. Using the tide calendar marigram, find the amount of time that each marker is exposed (dry) on June 3rd?
3. What would be the tidal time each marker spends underwater on June 3rd?
4. Which markers are underwater and which markers are dry at 0600 hours?
5. Between what two markers is the water line at 1300 hours?
6. Sea anemone prefer to live below the Mean (average) low Low water(MLLW) or zero tide line. At what markers would you search or sea anemone?
7. The sea star can move up to marker D when the marker is underwater. How many hours could the sea star spend at D on June 3rd?

8. An oyster can be out of the water for 5 1/2 hours without being hurt. What is the highest marker on the beach at which it can survive on June 3rd?
9. Design a tide gauge to record tides that occur on this beach. Include a drawing of your gauge with your explanation of its operation.

ANSWER SHEET NAME..

1.A.................................. D...................................... G..................................
B................................. E......................................
C................................. F......................................

2. A.................................. D...................................... G..................................
B................................. E......................................
C................................. F......................................

3.A.................................. D...................................... G..................................
B................................. E......................................
C................................. F......................................

4.A.................................. D...................................... G..................................
B................................. E......................................
C................................. F......................................

5................................ 8....................................

6............................... 9----->

7...............................

....

BEACH SLOPE CROSS SECTION