NAME _____ *DATE* _____

INSTRUCTOR _____ *PERIOD* _____ *PARTNER* _____

UNIT 4: Plate Tectonics and Earth's Interior

LAB 4-4: ORIGIN OF THE HAWAIIAN ISLANDS

INTRODUCTION: The Hawaiian islands were created as the Pacific Plate traveled over a hot spot in the mantle. A **mantle plume** is believed to be the center of vertically rising convection cells, assumed to be deep below Earth's surface. Their effect upon the surface is the production of a **hot spot** which is the site of volcanic activity.

OBJECTIVE: By graphically comparing the age of the islands of the Hawaiian Islands and seamounts and studying a map of the Hawaiian Islands, you will be able to infer the location of the hot spot and the direction and rate of movement of the Pacific Plate.

VOCABULARY:

mantle plume:

hot spot:

seamount:

guyot:

PROCEDURE A:

1. Using the information in Data Table 1, plot a graph that compares the age of the Hawaiian Islands and seamounts to their longitude.
2. Next to each point, label the name of the island.
3. Connect the points with a smooth line.
4. Estimate the age of Nihoa and plot its position on the graph.

PROCEDURE B:

1. Using the information in Data Table 1, plot the ages of the following islands on the map of the Hawaiian Islands: Kauai, Oahu, Molokai, Maui, Hawaii (at Kilauea Volcano).
2. Using the map scale, calculate the distance from each island to Kilauea Volcano by measuring from the center of each volcanic peak at the end of the long pointer line. Using the map scale, determine the actual distance in kilometers. (Record this information in Data Table 2).
3. Convert the actual distance in kilometers from each island to Kilauea Volcano to centimeters and record in Data Table 2.
4. Using the distance and approximate age (in millions of years), calculate the average rate of movement for each island in centimeters per year (cm/yr).
5. Show all calculations for distance and rate on separate paper.

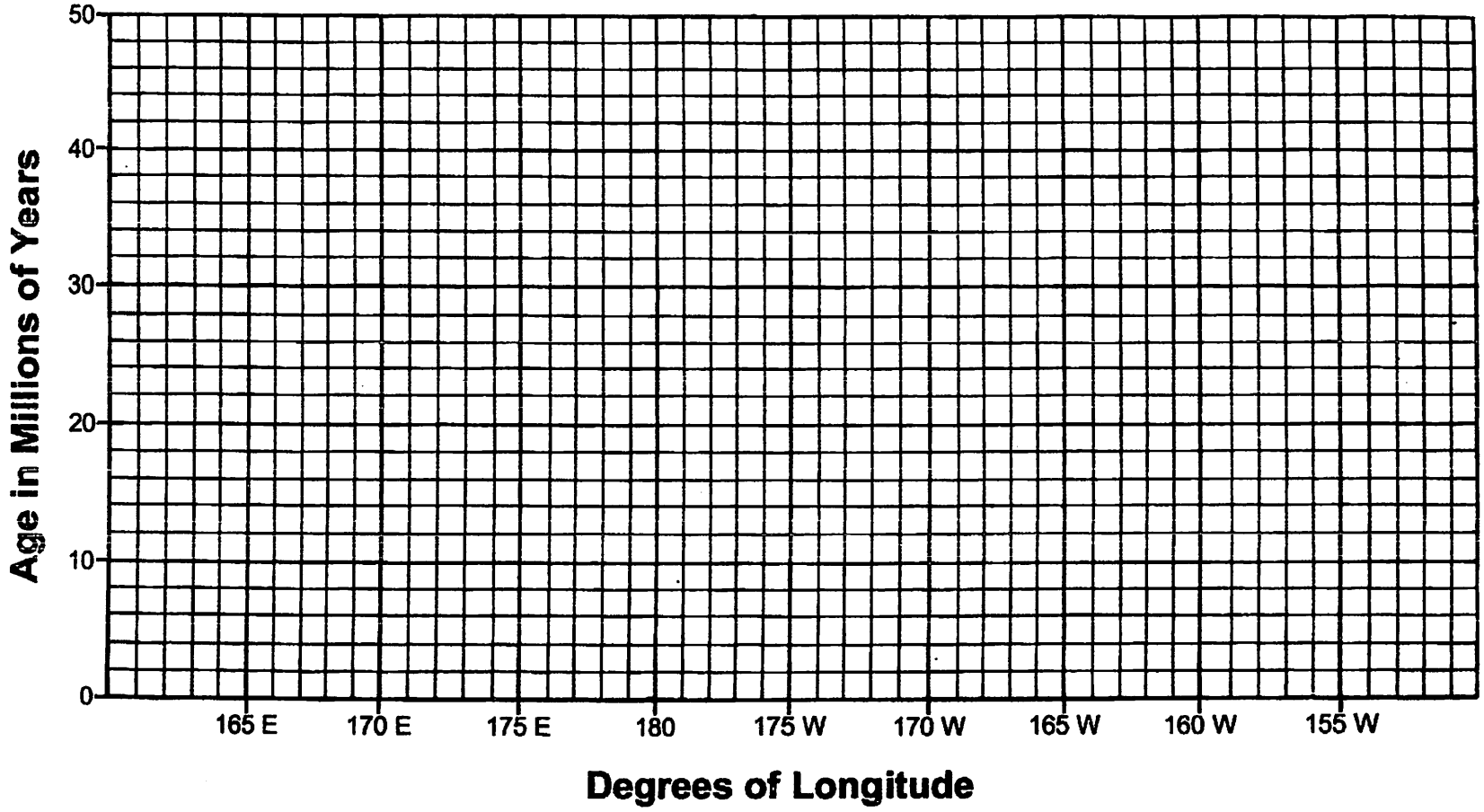
DATA TABLE 1

Island (or reef)	Approximate age (in millions of years)	Longitude (in degrees & minutes)
Hawaii	0.5	155° 30' W
Kanum	39.0	170° E
Kauai	4.7	158° 30' W
Maui	1.1	156° 15' W
Midway	18.0	177° 30' W
Molokai	1.6	157° W
Necker	10.1	164° 30' W
Nihoa	no data provided	162° W
Oahu	2.5	158° W
Pearl	20.1	176° W
Yuruaku	42.3	168° 30' E

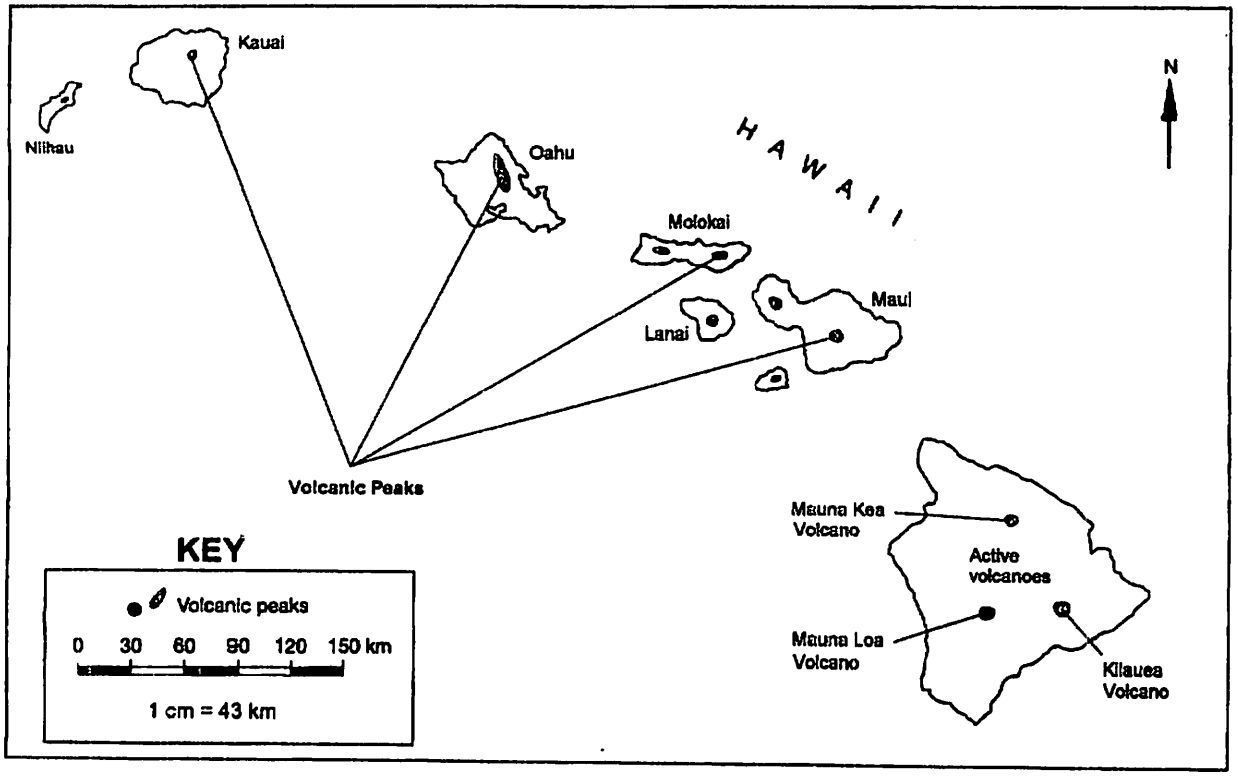
DATA TABLE 2

Island	Measured Distance (cm)	Actual Distance (km)	Actual Distance (converted to cm)	Approximate Age in years	Average Rate (cm/year)
Kauai					
Ohau					
Molokai					
Maui					

AGE OF THE HAWAIIAN ISLANDS



HAWAII MAP



Map of the Hawaiian Islands, showing volcanic peaks. Absolute ages were determined from basalts that form the islands.

DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. Referring to Data Table 1, which island is the youngest?

2. Referring to Data Table 1, which island is the oldest?

3. Referring to the Hawaii map and your graph, what is the relationship between the ages of the islands and their longitude?

4. Based on Procedure A-4, what is the inferred age of Nihoa?

5. Which island does not seem to fit the pattern of the others?

6. What inference can you make about the relationship between the general trend in island (or seamount) size and increase in distance west of Kilauea?

7. What is the reason for the inferred relationship between the distance from Kilauea and the island size that was identified in Question 6?

8. Predict where the next volcanic Hawaiian island will form.

9. Based on Procedure B, describe the change in the rate of movement of the Pacific Plate during the last 4.7 million years.

10. In which direction is the Pacific Plate moving?

11. What would be the shape of a line drawn along the Hawaiian Island chain and continued through the Emperor Seamount chain? (Refer to a world map or globe.)

12. From the pattern of the line identified in question 11, what could be inferred about the direction the Pacific Plate has moved?

CONCLUSION: Describe how the Hawaiian islands have formed.