

## A. Relative plate motions (20 points)

Key

Use Map 1 for questions a-c.

- (1) a.) Find South America. Notice the plate boundary along the west coast. The majority of faults along this plate are of what type?

~~Reverse~~ ~~Oceanic~~ thrust

- (1) b) Describe what happens at the Nazca/South American plate border.

dense Oceanic crust subducts under continental crust

- (1) c) What sort of landform would you expect to see at this boundary?

mountain range or trench

- (2) d) Now look at Map 2. What 2 types of boundaries are being depicted here?

divergent + transform

- (1) e) What sort of landform would you expect to see at this boundary?

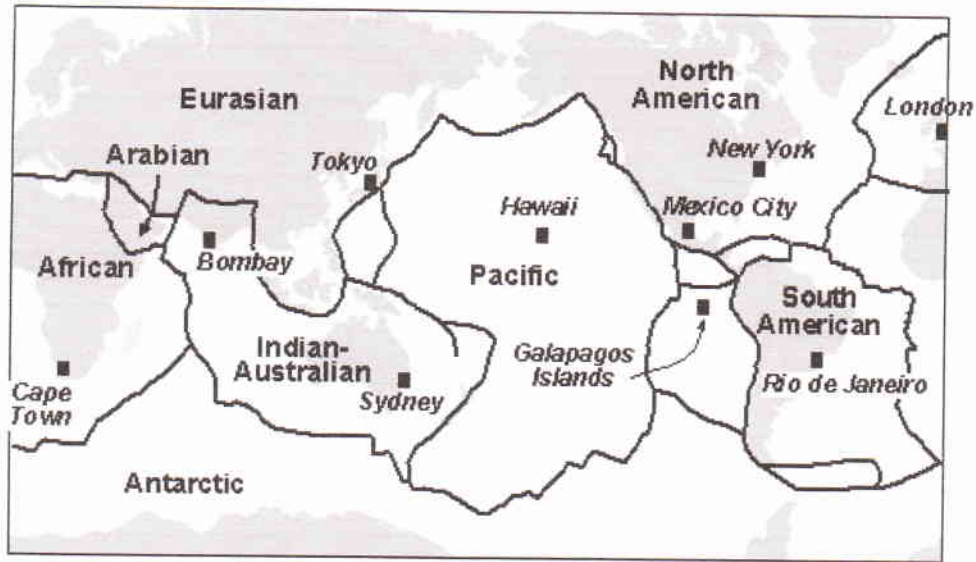
mid-ocean ridge

- (1) f) Use Map 3. The arrows indicate movement plus, the length of arrows indicates velocities. In what part of the world do you find the fastest moving plates?

South Pacific

- (1) g) How does the velocity of the plate movement relate to the frequency of earthquakes?

greater velocity = more frequent earthquakes



h) Review the map of plate movement and predict which pair of locations is moving closer together as a result of plate tectonics?

- a. Bombay & Sydney
- b. Hawaii & Tokyo
- c. New York and London
- d. Cape Town & Sydney

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**B. Volcanoes**

(2) 1. Of which of the following (a'a', pahoehoe, volcanic dyke, lahar deposit) is this an example? How do you know?

pahoehoe - ropy texture

(1) 2. The geologists on the right are sitting on pillow basalts. How are these formed?

formed by gentle emissions of lava underwater,  
often along mid-ocean ridges

(2) 3. The objects in Picture 3 (with the obvious exception of the dime in the lower right) are a type of volcanic debris named after a Hawaiian volcano goddess. What are they called and what are they made of?

Pele's tears - volcanic glass

(1) 4. The sample at this station was ejected from a volcano. What is this commonly called?

volcanic bomb or lava bomb



**C. Earthquakes**

The data at this station shows the difference in P & S arrival times from three stations for the Dec 26, 2004 earthquake in Sumatra. Use the data and the graph to determine how far each station was from the epicenter, then triangulate the epicenter on the map on the next page. **Clearly label the epicenter.**

Station	Difference in P/S wave arrival time	Distance to epicenter
IC.LSA	5 min 35 sec	3800 Km
KMBO	8 min	6800 Km
GUMO	7 min 10 sec	5250 Km

1 pt each

↑  
give range of  
+/- 5 sec

↑  
give range of  
+/- 200 Km

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**D. Interpreting seismograms**

1. What is the initial speed of the P waves to reach the first station at Hainan China (an angular separation of 22 degrees)?

(2)

$$22^\circ \text{ in } 5 \text{ min} = 2000 \text{ km} / 300 \text{ sec} = 6.6 \text{ km/s}$$

accept anything  
b/n 6-7 km/s

2. What is the average speed of the P waves to reach the station at Otavalo, Ecuador (an angular separation of 172 degrees)?

(2)

Since P waves go through the earth - the actual distance traveled is 12,600 km time is 1200 sec. speed = 10 km/s

3. Why does the P wave reach Ecuador (at 170 degrees) before it reaches the station at Missoula, MT (at an angular separation of 124 degrees)

(2)

Something about P waves traveling through core at higher velocities

4. Calculate the speed of the surface waves in the seismograms. How long will they take to circle the globe completely? (Note: when this happened for this earthquake it seems to have helped to trigger a magnitude 7.1 aftershock).

(2)

give credit b/n 3 km/s + 4 km/s

It would take about 200 minutes

5. Describe a situation where an earthquake's Richter number was high, but the Mercalli number was low.

(2)

if earthquake occurs in an uninhabited area, a large earthquake could cause little damage