

EPSC 353 Earth Forces
Test 1
February 12, 2003
Closed book, closed notes
100 points total

Name _____

I. Short answer/essay

1. Describe how geophysicists can determine the *current* plate motions of the earth. What type of data are used? What new technologies are being used to measure instantaneous plate motions (no averaging over geological time)? (12 pts)

2. Now describe how geophysicists determine *past* plate motions (18 pts)

A) What types of data would be used for a 60 Ma. reconstruction?

B) What types of data would be used for a 300 Ma. reconstruction? What types of uncertainties would there be in this reconstruction? Why would it be less accurate than the 60 Ma. reconstruction?

C) How are plate reconstructions useful for paleoclimate studies?

3. After a major earthquake, which seismic phases would be observed on each component of a seismograph? In each case also give the order in which the phases would be observed. (8 pts)

A) vertical component

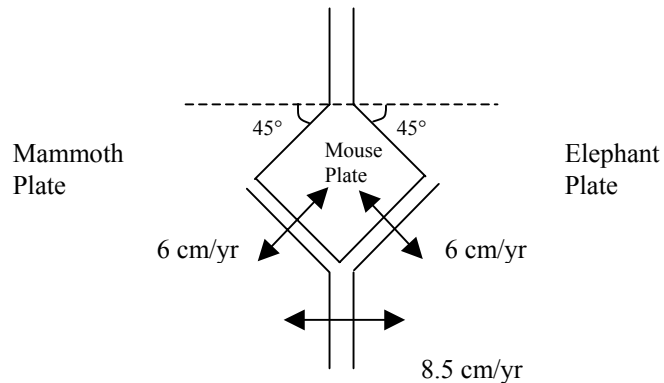
B) radial component (measures horizontal motion in the direction of the earthquake)

C) transverse component (measures horizontal motion perpendicular to the earthquake direction)

4. What methods are used to study the seismic velocity structure of the ***mantle***? Give a short description of each method. (12 pts)

II. Problems

1) Small plates (microplates) often form along fast spreading ridges. An example is the Easter plate near Easter Island in the Pacific. Some plate reconstructions show that the Pacific plate started out as such a microplate. Let's analyze the kinematics of a hypothetical microplate system. Assume that all ridges are currently spreading orthogonally and symmetrically. (25 pts)



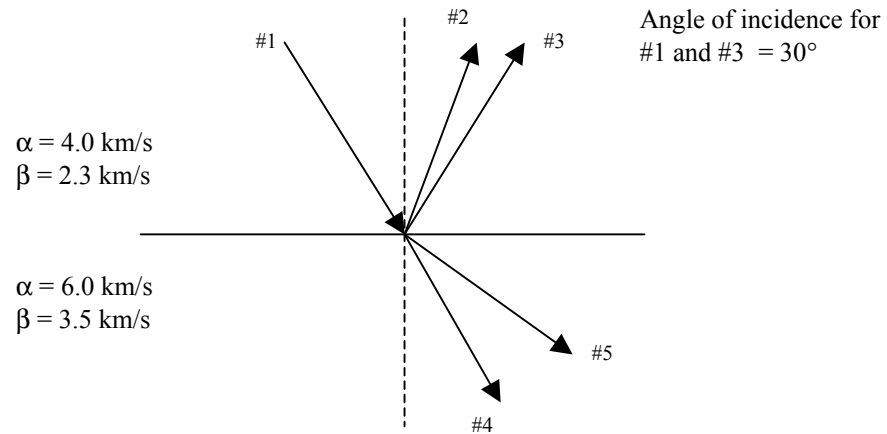
a) Draw velocity vector diagrams for both triple junctions.

b) Check for triple junction stability. Are both triple junctions stable? For any stable triple junction, give the velocity of the triple junction relative to the Mouse Plate.

c) What will probably happen in the future? Diagram a possible plate configuration 1 m.y. from now. How much larger is the mouse plate?

2. A seismic wave incident on an interface results in four reflected and transmitted rays. (25 pts total)

A) Identify all the rays as P or S.



B) Calculate the angle of incidence for rays #3, #4, #5.

C) Suppose the incidence angle of ray #1 is increased. What are the critical *angles* for transmission into material #2?