

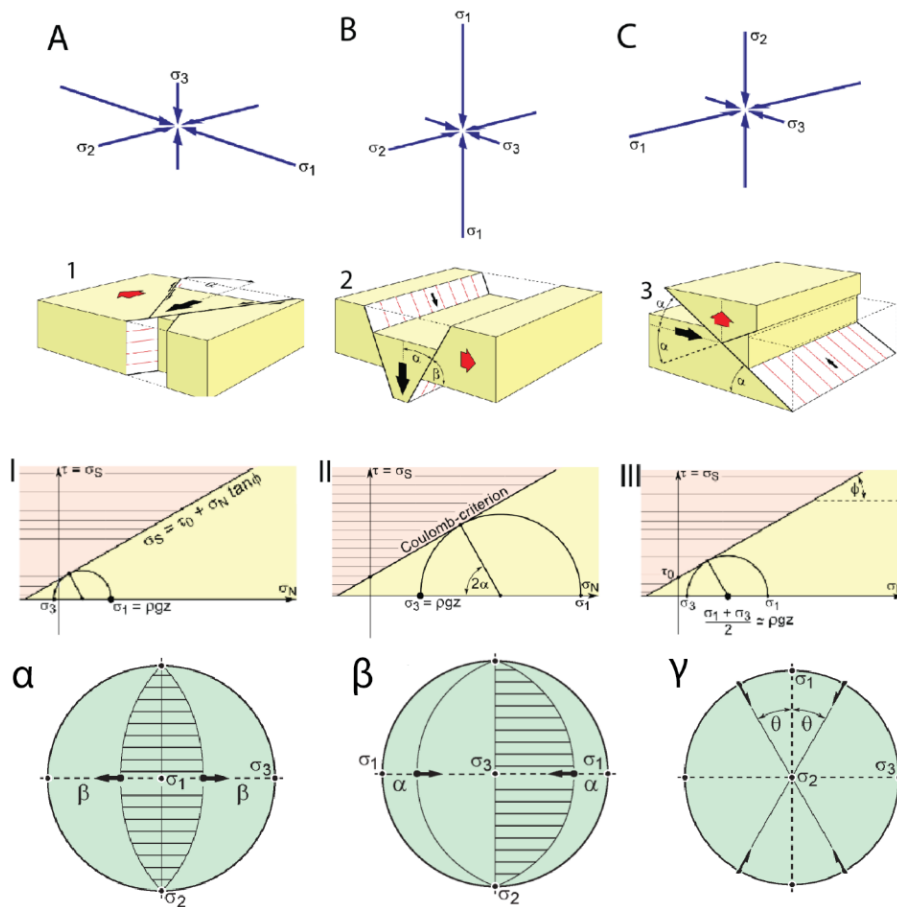
SECTION A: (90 MARKS)

Question 1: Brittle deformation. (24 marks)

1.1. Associate the diagrams A, B and C representing the orientation of principal stresses with the 3D sketches of fault systems (1, 2 and 3), the Mohr circles (I, II, III), and the stereonet (α, β, γ). (18 marks)

Example: A-1-I-α.

1.2. Which of those corresponds to thrusts, normal and strike slip faults? (6 marks)



Question 2: Fabrics and shear zones. (14 marks)

2.1. What is(are) the difference(s) between an S-tectonite and an L-tectonite? Use annotated sketches to illustrate your answer. (6 marks)

2.2. Name and sketch at least three different kinds of kinematic criteria in shear zones. (9 marks)

Question 3: Rheology. (12 marks)

- 3.1. Explain the role of pore fluid pressure in deformation of rocks and how it relates to effective pressure. Use an annotated Mohr diagram to explain your answer. (6 marks)
- 3.2. What are the main parameters controlling the rheological response of crustal material? Use annotated diagrams to answer. (6 marks)

Question 4: Folding and fabrics. (27 marks)

- 4.1. Which kind of structures are shown in the photo below? (8 marks)
- 4.2. Explain how the structures in the photo below formed. (7 marks)



- 4.3. For which folding mechanism a neutral line develops? Use annotated sketches to answer. (6 marks)
- 4.4. Give at least two different types of lineations typically formed during folding. Explain how they form. (6 marks)

Question 5: Fabrics and shear zones. (13 marks)

- 5.1. In which section(s) of the finite strain ellipsoid kinematic analyses is performed. (4 marks)
- 5.2. Discuss (with examples) the difference between foliation and lineation rock fabric. (5 marks)
- 5.3. Draw a porphyroblast and a porphyroclast and explain the differences. (4 marks)

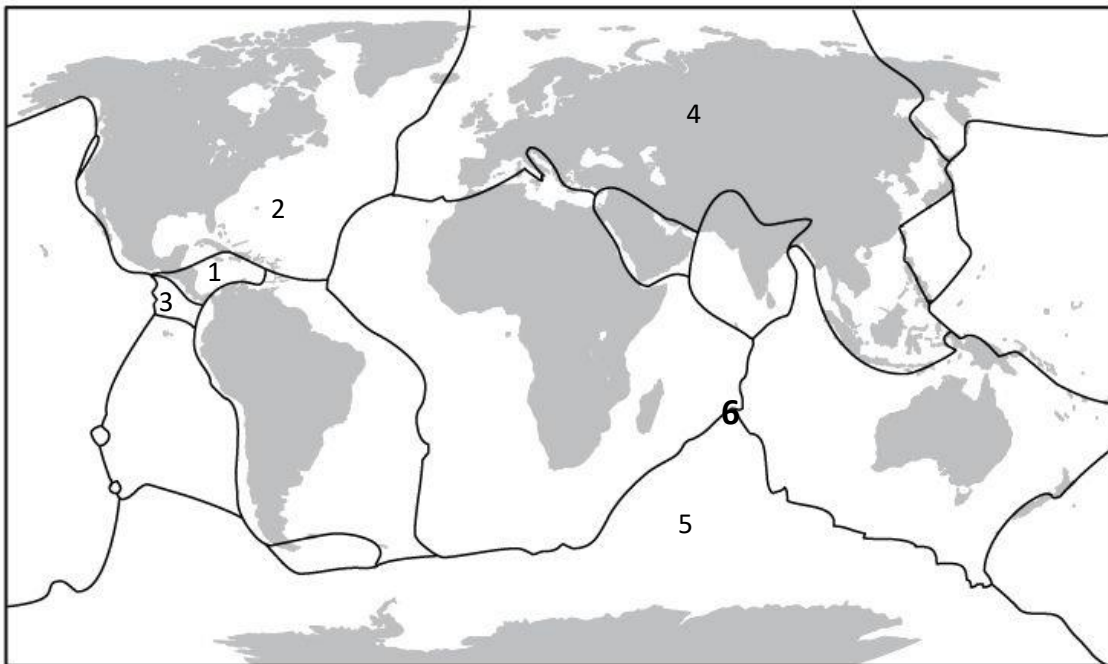
SECTION B: (90 MARKS)

Question 8: Contrast the plate tectonic setting of north-south trending fast spreading ocean ridge and a north-south trending ensialic island arc with an overriding plate located in the east. (50 marks)

Your answer should be in essay form (like summarized study notes) and should be structured under the following headings:

- Lithospheric structure (30 marks)
 - Provide a lithospheric cross section of each of the systems and indicate the following:
 - Thickness, its variation and nature (continental vs oceanic) of crust
 - Thickness and its variation of the mantle lithosphere
 - Label the asthenosphere
 - Dominant structures and their nature (i.e., normal, reverse, or transform; ductile or brittle)
 - Locality and depth distribution of earthquakes
 - Locality of volcanism on the surface
- Seismicity (10 marks)
 - Provide typical focal mechanism solutions for earthquakes that characterize the systems
- Magmatism (10 marks)
 - Typical expected magmatic rocks/compositions
 - Change in composition through space and time

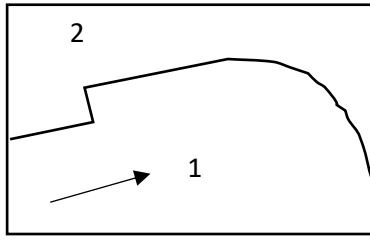
Question 9: Tectonic plates (20 marks)



9.1. Label the numbered plates 1 to 5 (5 marks)

9.2. What physically are the plates that are referred to in plate tectonics? (3 marks)

9.3. Briefly illustrate and describe the nature of the plate boundary between 1 and 2 if plate 1 is moving to the east-north-east at a velocity of 0.8 cm/yr as indicated below (4 marks)



9.4. A triple junction is formed by three spreading ridges at point 6. Explain why such a triple junction would ideally be dynamically stable? Why would a triple junction formed by three transform faults always be dynamically unstable? Illustrate your answer. (8 marks)

Question 10: Paleomagnetism (20 marks)

What is paleomagnetism and how is it used to reconstruct ancient continents? Use the following keywords to compose your answer:

- Geocentric-Axial Dipole (GAD) Hypothesis
- Virtual geomagnetic pole (VGP)
- Paleomagnetic pole
- Apparent polar wander (APW) path
- Closest approach reconstruction
- APW method of reconstruction