

DEPARTMENT OF GEOLOGY

MODULE CODE	GLG2B10
MODULE NAME	Structural Geology and Plate Tectonics
CAMPUS	APK
EXAM	December 2015 (Supplementary)

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Date	November December supplementary exam 2015
Assessor(S)	Dr Herman van Niekerk Dr Jeremie Lehmann
Internal Moderator	Dr Bertus Smith
External Moderator	
Duration	180 minutes
Marks	180

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Number of pages	63 (including front page)
Instructions	Answer all the questions

~~November supplementary exam~~

GLG2B10—Structural Geology and Plate Tectonics

Dr Herman van Niekerk

Question 1

Make a sketch that shows in detail the variation in S and P wave velocities with depth in the Earth. Ensure that you indicate the variation in velocities in relation to the internal structure of the Earth and state if the different layers are “fluid” or “solid” in nature. (20)

Question 2

- a) Name the different types of seismic waves associated with earthquakes and indicate which of these are responsible for damage caused during seismic events (7 marks)
- b) Make a sketch that illustrates the internal structure of the earth, and along with this sketch indicate the S-wave velocities. Be sure to indicate the depths at which the different components of the earth start and end (10 marks).

Question 3

Make sketches that show the following plate tectonic scenarios:

Please note: Ensure that the sketches are balanced, in other words a process producing new crust must balance crust being destroyed in another place. Label the sketches carefully and indicate relative movement directions with arrows. Also give a real world example of each.

- a) A contracting ocean (14)
- b) The formation of a continental island arc (9)
- c) An oceanic island arc with a marginal sea situated between the arc and a continent (9)
- d) An expanding ocean (6)

Question 4

Explain how sea floor spreading and geomagnetic field reversals relate to each other (10) and how this interaction can be used to determine the ages of sedimentary rocks deposited far away from ocean (5). Use sketches to supplement your answers.

Section 2 - Structural geology (90 Marks)

Total pages: 1

Don't hesitate to use simple equations and/or simple sketches in your answers.

And good luck!

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1. Stress and strain

- a. Explain the relationship between force and stress (5)
- b. Provide two-dimensional sketches and two-dimensional stress and strain ellipses for the following strain states:
 - General shear.
 - Pure shear.
 - Simple shear. (18)

2. Rheology (18)

Explain by means of annotated (labelled) diagrams the differences between elastic, plastic and visquous models of deformation.

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3. Brittle deformation

- a. Draw, using three-dimensional sketches, a dextral and sinistral strike-slip fault (2 sketches in total). (4)
- b. Define by means of annotated sketches the difference between (18)
 - i. joints.
 - ii. stylolites.
 - iii. tension gashes.
 - iv. shear fractures (i.e. faults).

4. Homogenous and heterogeneous deformation

- a. Explain by means of annotated sketches the differences between isotropic, anisotropic, homogenous and heterogeneous material. (12)
- b. Define FIVE different types of linear fabrics that a geologist can encounter in the field. (15)