**Structural Geology Problems – Chapters 2 – 7**

1. A quartz crystal has a length of 10 cm. An extensional stress of 36 GPa is applied to the quartz crystal and its length increases to 15 cm. Calculate the following:

 a. Elongation

 b. Stretch

 c. Young’s modulus

2. During simple shearing a belemnite which was originally oriented north-south is rotated so that it now is oriented N20E. Calculate the shear strain.

3. A rock contains oolites, which before deformation were spherical in shape and were 1 cm in diameter. Following deformation the oolites have the following dimensions: 5 cm x 3 cm x 2 cm. Calculate the Flinn k-value. Does the deformed oolite have a prolate or oblate geometry?

4. Calculate the lithostatic stress exerted by a column of rock with a height of 1 km and a density of 2700 kg m-3. If this vertical stress acts on a surface that is dipping at 40o, calculate the normal and shear stress on this surface.

5. Using the uniaxial-strain reference, calculate the vertical and horizontal stress at a depth of 500 m given a rock density of 2600 kg m-3 and a poisson’s ratio of 0.2.

6. A layer of shale occurs at a depth of 1200 m. During erosion the shale layer moves to within 800 m of the surface. Calculate the change in horizontal stress on the shale layer. For this problem assume that all the rock above the shale has a density of 2650 kg m-3 and that the geothermal gradient is 5oC/1000 m. For the shale Young’s modulus = 20 GPa, Poisson’s ratio = 0.25, and the linear thermal expansion coefficient = 6 x 10-6 oC-1.

7. The melting temperature for anorthite (a Ca-plagioclase) is 1696 oC. An igneous rock that contains anorthite has cooled to a temperature of 800 oC. Calculate the homologous temperature for the anorthite.

8. Construct a Mohr diagram for a rock with the following experimental properties: cohesive strength = 120 MPa, φ = 50o for the Coulomb-Mohr fracture criteria, and φ = 38o for the sliding friction envelope. Determine the following:

 a. Orientation of fractures that will yield before the rock fractures. Use 400 MPa for your circle center.

 b. The strength of the rock when subjected to a tensile stress.