Exam Scores out of 96

Count

Range

60  65  70  75  80  85  90
1) a) Sketch a **parallel (concentric) fold** and a **similar fold**. b) Which fold geometry would you most likely find in a core complex in Death Valley and which would you likely find in a shallowly-buried, inter-beded sandstone shale sequence in the California Coast Ranges. c) What does the geometry of the folded layers tell you in each case about the conditions of deformation?

![Diagram of folds](image)

2) a) Does the image below, from Monarch Canyon, suggest pure shear or simple shear? b) What is the direction of tectonic transport in this shear zone? Show with arrows indicating relative displacement. c) What features allow you to determine tectonic transport direction (identify two different features)?

![Image of Monarch Canyon](image)

- **Simple Shear**
- **Top to right**
- **Tect. Transport**
- **Asymmetric Folds**
- **Fold Geometry**
3) This is the contact between the upper and lower plates of the low angle normal fault in upper Monarch Canyon. a) What structure is Paul aligning his left hand with and b) what does this tell you about the transport direction of the upper plate relative to the lower plate?

4) a) Sketch the orientation of foliation that is likely to occur in the fold structure below.

![Foliation sketch]

b) What is pencil lineation? c) Show the orientation of pencil lineation that might occur with this fold geometry.
5) a) State the equations for determining longitudinal (extensional) and simple shear strain.

\[ e = \frac{1 - 1_0}{1_0} \]

Shear strain: \[ \gamma = \tan\theta \]

\[ \psi = 59^\circ \]

\[ j = \frac{21 \text{ mm}}{20 \text{ mm}} = 1.05 \]

\[ \frac{42 - 22}{22} = 0.91 \]

b) Calculate the maximum simple shear strain in (a) above and the maximum horizontal extensional stain in (b). c) Label (a) and (b) above as to which is coaxial and non-coaxial strain.

6) a) Specifically identify the type of fold and fault developed in this cross section of the originally horizontal layers. b) What is a balanced cross section? c) Does this cross section balance? Why or why not?
7) Describe the simple interpretations (Anderson's) of the orientations of maximum, intermediate, and minimum principal stress axes for the three major types of faults: normal, thrust, and strike-slip. Answer this question using 3 sketched block diagrams showing the principal stress axes and the associated fault geometries.

8) a) Draw a Mohr circle with Total Stresses $\sigma_1 = 80$ MPa, $\sigma_2 = 50$ MPa. Adding a fluid pressure of 40 MPa shifts Mohr Circle into contact with a failure envelope. b) Draw the Mohr circle as its fluid-pressure induced failure state. The rock has a cohesion of 5 MPa. c) Draw the failure envelope and estimate the coefficient of friction for the failure in its overpressured state. d) Is the rock failing as shear fracture or an extensional fracture? e) what is the angle between $\sigma_1$ and the failure surface?