

EXEMPLARY CORE COMPETENCIES IN PHYSICAL GEOLOGY LAB

The Geology 1403 instructors will administer final examinations that contain a common set of questions developed based on the following exemplary competencies:

Competency Area I: Minerals

- ✓ Know definition of a mineral
- ✓ Measure physical properties of minerals and their ranges of variability: Color, Luster, Hardness, Streak, Cleavage, Fracture, Crystal Form, HCL Reaction, Magnetism, Specific Gravity, Taste, Feel
- ✓ Use physical properties to group and distinguish common minerals
- ✓ Identify minerals with mineral charts

Competency Area II: Rocks

- ✓ Understand the difference between minerals and rocks
- ✓ Identify the minerals that are typical in igneous, sedimentary and metamorphic rocks
- ✓ Identify the textures that are typical of igneous, sedimentary and metamorphic rocks
- ✓ Identify igneous, metamorphic, and sedimentary rocks
- ✓ Relate grain size to cooling rates and general origin (plutonic vs volcanic)
- ✓ Relate igneous rock mineral assemblages to Bowen's Reaction Series
- ✓ Name sedimentary rocks and classify them as clastic, chemical or biochemical
- ✓ Infer origin of sedimentary rocks (depositional environments) based on knowledge of modern depositional environments
- ✓ Be able to define and distinguish the differences between igneous, sedimentary, and metamorphic rock
- ✓ Identify and describe types of foliation in metamorphic rocks
- ✓ Distinguish foliated and nonfoliated metamorphic rocks
- ✓ Relate plate tectonic environments to metamorphic diagram

Competency Area III: Maps

- ✓ Define contour lines and understand their characteristics
 - Identify contour interval and index contours
 - Determine surface elevations, height and relief
 - Measure land slopes and directions
 - Determine stream-flow direction and gradient
- ✓ Contour a topographic map using elevation data
- ✓ Interpret cross sectional profiles of land surface and determine vertical exaggeration
- ✓ Use contour lines to read a topographic map and visualize the Earth's surface features
 - Recognize geometric shape of land surface
 - Identify topographic features
 - Read map symbols and identify cultural features
- ✓ Plot locations, distances and compass directions using map coordinates, land subdivisions and map projections

- Latitude and longitude
- Township, Range and Section
- Quadrangle maps (lat./long. boundaries; declination; publication dates, cultural features)
- ✓ Measure distances on Earth's surface using map scales (graphic, fractional and verbal)

Competency Area IV: Water As a Source

- ✓ Identify drainage basins (their boundaries and drainage divides)
- ✓ Construct stream longitudinal profiles and calculate their gradients
- ✓ Identify and measure river features (floodplains, natural levees, backswamps, meanders, cutbanks, point bars, oxbow lakes and stream terraces)
- ✓ Identify the types of drainage patterns and infer their underlying geological controls
- ✓ Determine the evolutionary stage of a river system (early, middle and late-stage) by identifying its associated valley characteristics and by inferring its balance between erosional and depositional processes
- ✓ Evaluate the relationships between the variables that control groundwater movement (porosity and permeability)
- ✓ Make a contour map of a water table using shoreline elevations
- ✓ Calculate the water table's direction of slope and hydraulic gradient

Competency Area V: Coastal Landforms

- ✓ Identify (on photographs and/or maps) and explain coastal features: spit, baymouth bar, tombolo, sea stack, headland, wave-cut cliff, wave-cut platform, barrier island, tidal flats, delta, beach, and associated features such as lagoon, tidal inlet, tidal delta, tidal flat
- ✓ Determine the direction of longshore current from the shape of a spit or groin

Competency Area VI: Geologic Time

- ✓ Determine the sequence of events (relative ages) on a cross-section using stratigraphic principles; the cross-sections should include normal and reverse faults, folds, magmatic intrusions, erosional surfaces, tilting
- ✓ Recognize unconformity surfaces and understand what events they represent
- ✓ Understand the basic concepts of radiometric age determination

Competency Area VII: Structure and Geologic Maps

- ✓ Measure strike and dip
- ✓ Plot strike and dip on a map
- ✓ Determine the general orientation of strike and dip on surface of a block diagram
- ✓ Recognize structural geology symbols used on maps: strike and dip; folds; faults
- ✓ Define, sketch, and recognize a dome or basin, and plunging and non-plunging anticline and syncline on a block diagram

- ✓ Determine the direction of plunge of plunging anticlines and synclines on a block diagram
- ✓ Define, sketch, and recognize a normal, reverse and strike slip fault on a cross-section or block diagram
- ✓ Distinguish the hanging wall and footwall of a normal, reverse, and thrust fault on a cross-section and a block diagram
- ✓ Recognize horizontal, inclined, folded, and faulted strata; unconformities; and igneous intrusions on geologic maps
- ✓ Determine relative ages of formations on a geologic map by using the principle of superposition
- ✓ Construct a cross-section from a geologic map. The cross-section may include folds and faults.
- ✓ Use the rule of Vs to determine direction of dip for strata

Competency Area VIII: Earthquakes and Plate Tectonics

- ✓ Identify P, S, and surface waves on a simple seismogram
- ✓ Locate the epicenter of an earthquake using seismograms and travel-time curves
- ✓ Determine the magnitude of an earthquake using a Richter magnitude chart
- ✓ Determine the time of an earthquake (using the time of observance and the distance-time chart)
- ✓ Correlate magnetic profiles (a) along a divergent boundary and (b) with the geomagnetic polarity time scale
- ✓ Calculate sea floor spreading (divergence) rates from magnetic anomalies (paleo-magnetic records, given their ages
- ✓ Recognize types of plate boundaries and their associated features on sea floor maps and/or topographic profiles