

Geology 101  
Exam 3 - Fall 2010 - Version A

name \_\_\_\_\_

Short Answer Questions -- Answer all of these.

1. Uranium<sup>235</sup> decays to lead<sup>207</sup> with a half-life of 713 million year. Suppose a sample of granite crystallized sometime in the past from a magma and initially contained 10,000 atoms of U<sup>235</sup> (and no Pb<sup>207</sup>). Today you analyze it and find that it contains only 1,250 atoms of U<sup>235</sup> and 8750 atoms of Pb<sup>207</sup>. How old is the granite? i.e., How long ago did it crystallize? Did the granite form during the Cenozoic, Mesozoic, Paleozoic, or Precambrian?

2. Some sedimentary rock formations are found over very large areas. The Pierre Shale, for example, is a Cretaceous formation found in many states of the Great Plains and Rocky Mountains. Some formations, however, only crop out in a single state or even a single part of a state. Explain why some formations have wide extent, while others do not.

3. Some minerals are very common in clastic sedimentary rocks. Which minerals? Why these minerals?

4. Look at the block diagram below.

a. Use an arrow to clearly indicate the oldest rock formation.

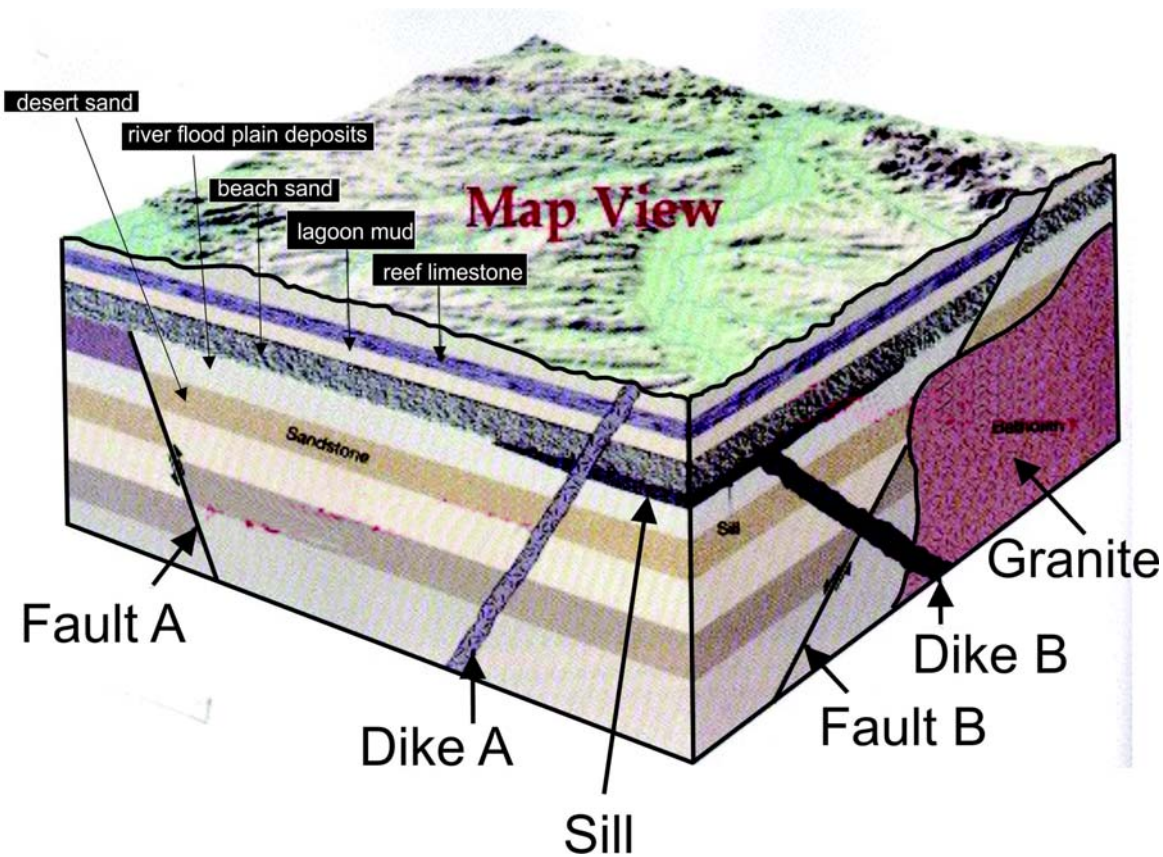
b. Use an arrow to clearly indicate the youngest rock formation.

c. Which of the following is oldest: Fault A, Fault B, Dike A, or Dike B?

d. Which of the following is youngest: the Granite, the Sill, Fault A, Fault B, Dike A, or Dike B?

e. Place these three in the correct age order: the desert sand, the Sill, Fault A.

5. A bright young geologist studied five of the formation in the block diagram and determined the environments where they were deposited. They are labeled in black boxes. Explain the sequence of different sediment types. Why are they what they are, and why are they in the order they are.



## Multiple Choice Questions

1	<p>What version of this test are you taking?</p> <p>a) &lt;== You better choose this answer are you won't be happy</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>e)</p>
2	<p>You look at a stratigraphic column for Capitol Reef National Park and find some distinctive rock formations, containing distinctive fossils, near the bottom. Then you look at a stratigraphic column for an area farther southwest (near Kanab) and find the same formations and fossils near the top of the column. What can you conclude?</p> <p>a) the rocks near Kanab are, in general, older</p> <p>b) the rocks in Capitol Reef are, in general, older</p> <p>c) the rocks in the two places are about the same age</p> <p>d) there is an unconformity between Kanab and Capitol Reef</p> <p>e) there is a facies change between Kanab and Capitol Reef</p>
3	<p>The Goosenecks are a famous site in Utah where river meanders have carved a deep canyon through flat-lying Permian rocks. Where are the youngest rocks found in this region?</p> <p>a) Near the banks of the river</p> <p>b) On top of low plateaus in the center of some of the meanders</p> <p>c) Part way up the canyon walls</p> <p>d) On the high-elevation flat lands away from the meanders</p> <p>e) ALL the rocks in the region formed at the same time, so none are younger than the others</p>
4	<p>A rock is a black and white banded rock with coarse crystals of biotite, quartz, and garnet. Foliation is associated with the folds. What is the correct name for this rock?</p> <p>a) slate</p> <p>b) gneiss</p> <p>c) marble</p> <p>d) greenstone</p> <p>e) granite</p>
5	<p>Which environment is a setting that can deposit sand?</p> <p>a) landslide</p> <p>b) evaporating lake</p> <p>c) deep ocean away from land</p> <p>d) turbidity currents along a continental slope</p> <p>e) ALL answers are correct</p>
6	<p>You look at a mountainside and see a normal fault. To the west of the fault you see a stack of sedimentary rock layers. To the east of the fault you see granites and gneisses (basement rocks) overlain by the same sedimentary rock layers. Which way does the fault slope?</p> <p>a) It slopes down to the west</p> <p>b) It slopes down to the east</p> <p>c) It is vertical</p>
7	<p>You look at a mountainside and see a reverse fault. To the west of the fault you see a stack of sedimentary rock layers. To the east of the fault you see gneisses intruded by granites (basement rocks) overlain by the same sedimentary rock layers. Which rocks are most likely to be Precambrian?</p> <p>a) The sedimentary rocks west of the fault</p> <p>b) The sedimentary rocks east of the fault</p> <p>c) The granites</p> <p>d) The gneisses</p> <p>e) There is no way to tell</p>
8	<p>You hike up a sloping limestone formation on one side of a ridge. After you go over the top and start down the</p>

	<p>other side, you find yourself going down the same limestone formation, but the slope is steeper. What kind of structure are you walking over?</p> <p>a) horizontal syncline  b) plunging anticline  c) plunging syncline  d) asymmetric anticline  e) asymmetric syncline</p>
9	<p>You are bopping along a stream valley and it takes a sharp jog to the left before continuing in the original direction. You notice that other streams in the region also have similar jogs. What is most likely the cause of these features?</p> <p>a) a fold in metamorphic rocks  b) a scarp along a strike-slip fault  c) erosion of gently tilted layers  d) a hogback  e) regional schistosity</p>
10	<p>When did fishes and creatures with shells appear on Earth?</p> <p>a) Mesozoic  b) Cenozoic  c) Precambrian  d) Paleozoic  e) NONE of the answers are correct</p>
11	<p>How does an angular unconformity form?</p> <p>a) rocks are folded into an angle and the top is removed by faulting  b) older rocks are tilted, eroded, and overlain by younger rocks  c) rock layers are turned upside down at an angle  d) angular rocks are deposited on top of flat-lying layers  e) any of these</p>
12	<p>Large, angular clasts are most likely at:</p> <p>a) On mountain slopes  b) Near where a glacier ends  c) In braided rivers  d) In deltas  e) On mountain slopes OR near where a glacier ends but not in deltas or braided rivers</p>
13	<p>In some desert areas the ground is covered by a jumble of pebbles and larger rocks of varying sizes (often angular), with very little fine sand or other sediment mixed in. What do we call this?</p> <p>a) contact metamorphism  b) unconformity  c) desert varnish  d) desert pavement  e) none of these</p>
14	<p>If you look at a metamorphic rock and see light and dark bands (containing different minerals) that are all parallel, what might be the cause of those bands?</p> <p>a) cleavage in slate  b) hornfels in a granoblastic rock  c) foliation in banded gneiss  d) thrust fault  e) schistosity</p>
15	<p>If you look at satellite photos (or geologic maps) of Pennsylvania, in many places you will see high ridges that curve back and forth forming "S" patterns. In some places they fold back and forth many times, looking somewhat like a squiggly snake. The ridges are made of quartzite which is erosion resistant; the surrounding rocks are softer (mostly shale) and so erode to produce valleys. What kinds of structures are present in this part of Pennsylvania?</p>

	<ul style="list-style-type: none"> <li>a) horizontal anticlines and syncline</li> <li>b) symmetrical vertical anticlines and syncline</li> <li>c) plunging anticline AND plunging syncline</li> <li>d) plunging syncline ONLY</li> <li>e) plunging anticline ONLY</li> </ul>
1 6	<p>What features can be used to interpret which way a prehistoric fault moved?</p> <ul style="list-style-type: none"> <li>a) scratch marks on the fault</li> <li>b) folding of rocks next to the fault</li> <li>c) the formation of folds along bends in a fault</li> <li>d) ALL answers are correct</li> <li>e) Scratch marks on the fault surface OR folding of rocks next to the fault, but NOT the formation of folds along bends in a fault</li> </ul>
1 7	<p>If metamorphism occurs beneath a subduction zone, it typically occurs at?</p> <ul style="list-style-type: none"> <li>a) Relatively low pressure and high temperature</li> <li>b) Relatively low temperature and high pressure</li> <li>c) VERY low pressure and temperature</li> <li>d) ANY pressure but high temperatures</li> <li>e) ANY temperature but high pressures</li> </ul>
1 8	<p>What is the best explanation if you find clasts that have no angular corners or edges?</p> <ul style="list-style-type: none"> <li>a) they are composed of relatively soft, soluble materials</li> <li>b) they accumulated on a steep slope</li> <li>c) they have been moved by the wind and rounded by blowing sand in sand dunes</li> <li>d) they have been transported a significant distance</li> <li>e) ALL answers are correct</li> </ul>
1 9	<p>What marks the boundary between the Mesozoic and the Cenozoic (called the K-T boundary)?</p> <ul style="list-style-type: none"> <li>a) the extinction of the dinosaurs</li> <li>b) the start of a rise to dominance of mammals</li> <li>c) a meteorite impact in Mexico</li> <li>d) all of these</li> <li>e) none of these</li> </ul>
2 0	<p>What do we call a bunch of similar rock strata that have similar composition, facies or other similar properties, making it convenient and easy to talk about them or to map them?</p> <ul style="list-style-type: none"> <li>a) Group</li> <li>b) Formation</li> <li>c) Bed</li> <li>d) Lithology</li> <li>e) Outcrop</li> </ul>
2 1	<p>What was the Cambrian explosion?</p> <ul style="list-style-type: none"> <li>a) a large volcano that went off in Wales, which the Romans called Cambria</li> <li>b) a meteorite impact that struck the north coast of the Yucatan Peninsula of Mexico</li> <li>c) a time when a meteorite collided with the center of a supercontinent, melting all the glaciers</li> <li>d) a time when many different types of creatures appeared on Earth</li> </ul>
2 2	<p>Which of these can tell us the direction that water was flowing when sediments were deposited?</p> <ul style="list-style-type: none"> <li>a) Shape of clasts</li> <li>b) Roundness of clasts</li> <li>c) Sorting</li> <li>d) Cross beds</li> <li>e) there is no way to tell</li> </ul>
2 3	<p>In the Grand Canyon, the dominant cliff-former is the Redwall Limestone; it is up to about 500 meters thick. It is a thick Mississippian age formation. In northeastern Utah, just a few hundred miles from the Grand Canyon, the only Mississippian-age rock is the 300-600 meter thick Leadville Dolomite. Which of the following is true?</p>

	<p>a) The Redwall Limestone and the Leadville Dolomite contain some of the same fossils. b) The two formations represent different facies of the same age. c) The different names may both refer to the same formation. d) The two formations may represent completely different depositional events. e) ALL of the answers could be correct.</p>
2 4	<p>You find a conglomerate that overlies a granitic pluton. The conglomerate contains cobbles made of granite from the pluton. Which is true?</p> <p>a) the conglomerate is younger than the granite because it is on top  b) the conglomerate is younger than the granite because it contains pieces of the underlying unit  c) the granite is older because it is a crystalline rock  d) the granite is younger because it is an intrusive rock  e) the conglomerate is older because it was intruded by the granite</p>
2 5	<p>A flat-lying conglomerate is covered by a thin formation of shale. The shale in turn is covered by a thick sandstone formation. All three units are cut by a dike made of basalt. Which is the oldest rock?</p> <p>a) conglomerate  b) shale  c) sandstone  d) dike  e) there is no way to tell</p>
2 6	<p>If a rock contains a poorly sorted mix of angular and rounded clasts, what does it tell you about how the material was deposited?</p> <p>a) It was deposited by the wind  b) It was transported a short distance  c) It was transported a long distance or worked by waves  d) It was deposited in a lake  e) It was completely lithified before deposition</p>
2 7	<p>How does a cross bed form?</p> <p>a) an abrupt change in the composition of the sediment  b) a gradual decrease in the strength of the current over time  c) piling of sediment down the front of a dune or ripple  d) a gradual change in the climate  e) two glaciers that cross</p>
2 8	<p>If you were designing a rock that resisted weathering, which of the following characteristics would it have?</p> <p>a) closely spaced fractures  b) a soluble chemical composition  c) a quartz-rich rock  d) a rock composed of abundant loose pieces  e) it would be a mafic volcanic rock</p>
2 9	<p>What is the difference between a joint and a fault?</p> <p>a) a joint is formed by confining pressure  b) a joint is formed by differential stress but a fault is not  c) a fault is formed by tension but a joint is formed by compression  d) a fault displaces the rocks on one side relative to another  e) joint are generally much large and involve more brittle materials</p>
3 0	<p>You analyze a dike and find that it is 55 million years old. The dike cuts across a sandstone formation. It is also covered by a quartzite. Which is likely true?</p> <p>a) The dike is older than the sandstone and the quartzite  b) The dike is younger than the sandstone and the quartzite  c) The dike is younger than the sandstone but older than the quartzite. d) The dike is older than the sandstone but younger than the quartzite  e) ALL answers are correct</p>
3	<p>In what environments does low pressure/high temperature metamorphism occur?</p>

1	<ul style="list-style-type: none"> <li>a) near magma but at shallow levels</li> <li>b) near magma but at deep levels</li> <li>c) under normal conditions of burial and heating</li> <li>d) in a subduction zone or accretionary prism</li> <li>e) NONE of these answers is correct</li> </ul>
3 2	<p>In what environments does high pressure/low temperature metamorphism occur?</p> <ul style="list-style-type: none"> <li>a) near magma but at shallow levels</li> <li>b) near magma but at deep levels</li> <li>c) under normal conditions of burial and heating</li> <li>d) in a subduction zone or accretionary prism</li> <li>e) NONE of these answers is correct</li> </ul>
3 3	<p>What sedimentary environments dominate the area around Vancouver, British Columbia?</p> <ul style="list-style-type: none"> <li>a) deposition of sediment carried by a braided river</li> <li>b) large landslides that blocked a narrow ocean channel</li> <li>c) large ocean waves that carry large boulders far inland</li> <li>d) a scenic offshore reef that protects the coastline from large waves</li> <li>e) talus slopes and fringing reefs</li> </ul>
3 4	<p>If you drive down the Yellowstone River valley between Gardiner and Livingston, Montana, you will see many river terraces at different levels. In some places, three or four different levels of terraces can be seen. What can you conclude about the uppermost terrace?</p> <ul style="list-style-type: none"> <li>a) It is older than the modern river channel</li> <li>b) It formed sometime in the past</li> <li>c) It predates erosion down to the present level</li> <li>d) It is older than the terrace beneath it</li> <li>e) all of these</li> </ul>
3 5	<p>You find a fault that involves only horizontal movement. What kind is it?</p> <ul style="list-style-type: none"> <li>a) normal fault</li> <li>b) reverse fault</li> <li>c) strike-slip fault</li> <li>d) oblique-slip faults</li> <li>e) thrust fault</li> </ul>
3 6	<p>What type of fault is especially common on mid-ocean ridges?</p> <ul style="list-style-type: none"> <li>a) dip-slip fault</li> <li>b) normal fault</li> <li>c) strike-slip fault</li> <li>d) reverse fault</li> <li>e) dip-slip OR normal fault only</li> </ul>
3 7	<p>When did mammals first become plentiful and very diverse on Earth?</p> <ul style="list-style-type: none"> <li>a) Mesozoic</li> <li>b) Cenozoic</li> <li>c) Precambrian</li> <li>d) Paleozoic</li> <li>e) Neogene</li> </ul>
3 8	<p>You study a fold in northern Iraq. In a map view (or a satellite view) it looks like one simple fold. The rock layers run to the northeast, curve around, and then continue to the southwest. If you look at a cross section of the fold, you find it is U-shaped. What kind of structure is this?</p> <ul style="list-style-type: none"> <li>a) horizontal anticline</li> <li>b) horizontal syncline</li> <li>c) plunging anticline</li> <li>d) plunging syncline</li> <li>e) asymmetric anticline</li> </ul>

3 9	Which of the following matches a sedimentary rock with a possible metamorphic equivalent? a) sandstone greenstone b) basalt marble c) limestone quartzite d) shale slate e) NONE of these answers is correct
4 0	Which of the following sites would have sand and silt deposited by slowing of the current? a) On mountain slopes b) Near where a glacier ends c) In braided rivers d) In deltas e) Near a stream's headwaters
4 1	Which of the following is NOT accurately dated at between 4 and 4.6 billion years old? a) the oldest dates on mineral grains on Earth b) age of the oldest meteorites c) age of moon rocks returned to Earth and dated d) isotopic ages on Earth's oldest known fossil shell
4 2	Which of the following is most likely to occur at deep crustal levels? a) ductile behavior b) brittle deformation c) fracturing d) only minor changes in minerals e) NONE of these answers is correct
4 3	Which of the following does NOT help create a foliation in metamorphic rocks? a) a dominant orientation of crystals, such as mica b) light- and dark-colored bands c) flattened shapes of deformed objects, such as pebbles d) crystals that grow in a random orientation e) ALL answers are correct
4 4	Which of the following features look like fossils but are not? a) footprints from dinosaurs and other creatures b) burrows excavated by worms and other creatures and filled by other sediment c) leaves and other plants formed on land d) dark minerals that grow in branching patterns e) all of these are fossils
4 5	Which of the following is a valid statement about how rocks respond to stress? a) If the stress is very high, the rock will be unchanged. b) Stress can cause a rock to be displaced, but not rotated. c) If a rock has strained, then it has changed its size or shape. d) A rock can be displaced or strained but not both at the same time. e) They dissolve and lose volume
4 6	Which of the following situations would result in angular clasts? a) transport of the clasts over long distance b) working of clasts by waves on a beach c) steep slopes in a mountain d) dunes formed by wind e) ALL answers are correct
4 7	Which of the following chapters in geologic time occurred before there were abundant animals with hard parts? a) Cenozoic b) Mesozoic c) Paleozoic

	<p>d) Precambrian e) Mammalian</p>
4 8	<p>Which of the following sites would most likely have turbidity currents?</p> <p>a) beach b) lagoon c) coral reef d) deep seafloor e) tidal flat</p>
4 9	<p>Which of the following is NOT a type of carbonate rock?</p> <p>a) limestone b) travertine c) dolostone d) shale e) a rock formed from a coral reef</p>
5 0	<p>Which of the following is NOT a common type of cement in sedimentary rocks?</p> <p>a) calcite b) pyroxene c) silica d) iron-oxide minerals e) carbonate material</p>
5 1	<p>Which of the following environments would most likely form limestone?</p> <p>a) beach b) lagoon c) coral reef d) deep seafloor e) tidal flat</p>
5 2	<p>Which of the following is most likely to occur at shallow crustal levels?</p> <p>a) ductile behavior b) brittle deformation c) growth of new minerals d) recrystallization of minerals e) metamorphism</p>
5 3	<p>Which of the following is a good interpretation of the environmental significance of an attribute of a sedimentary rock?</p> <p>a) Red rocks typically form in deep oceans. b) Thick bedding implies rapidly changing conditions. c) Fossils indicate that a sediment was deposited in water. d) Graded beds indicate that the strength of the current decreased through time. e) NONE of these answers are correct</p>
5 4	<p>Which of the following environments would most likely consist of sand and/or rounded cobbles?</p> <p>a) beach b) lagoon c) coral reef d) deep seafloor e) tidal flat</p>
5 5	<p>Which of the following is most likely to deposit a conglomerate?</p> <p>a) landslide b) braided river c) steep mountain front d) sand dunes e) lagoon</p>

5 6	Which of the following attributes does NOT apply to these sediments that are found deposited by landslides? a) angular clasts b) cobbles and boulders c) well sorted d) contains gravel e) contains sand and dirt
5 7	Which of the following is a characteristic of fine-grained clastic rocks? a) most clasts are visible with the unaided eye b) the rocks are poorly sorted c) the cobbles directly rest on one another without much matrix d) the rocks tend to be easily eroded e) they have an iron oxide cement
5 8	Which of the following can cause rocks to fold into large anticlines or synclines? a) Compressive forces b) Extension forces c) Gravity d) Differential stress e) ALL answers are correct
5 9	Which of the following is a common characteristic of carbonate rocks? a) they commonly have a dissolved appearance b) they are commonly black and shiny c) they are commonly reddish d) they do not form cliffs e) ALL answers are correct
6 0	Which of the following environments would likely have clasts smaller than sand? a) a weak current b) steep slopes c) dunes formed by wind d) All answers are correct e) a weak current OR steep slopes but NOT dunes formed by wind