Name _____

Lab section: Day _____ Hour _____

TA _____

GEO 303

Introduction to Geology

LAB FINAL EXAM

Spring, 1999

100 points

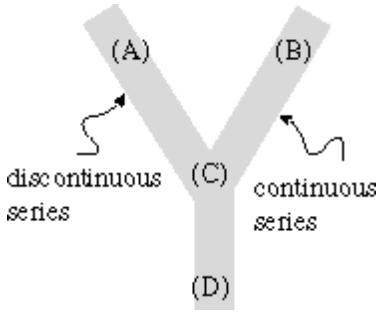
INSTRUCTION: This multiple-choice, machine-graded exam consists of 100 questions, each worth 1 point. Use a #2 pencil to "bubble in" the correct answer on the provided special answer sheet. For some questions, more than one answer could be correct. For example, suppose that both answers *A* and *B* are correct, *C* states that both *A* and *B* are correct, and *D* states that neither *A* nor *B* is correct. In this example, choose the overall most inclusive answer which would be *C*.

MINERALS, ROCKS, FOSSILS (14 points)

1. A coarse-grained, felsic igneous rock formed in an _____ environment is called _____. (A) extrusive, basalt; (B) extrusive, granite; (C) intrusive, rhyolite; (D) intrusive, granite.

2. Which one of the following is a progression from low grade to high-grade metamorphic rock? (A) gneiss→schist→phyllite→slate→shale; (B) slate→shale→schist→gneiss→phyllite; (C) shale→slate→phyllite→schist→gneiss; (D) marble→quartzite→schist→granite→limestone.

Questions 3 through 5 refer to the diagram of Bowen's Reaction Series drawn schematically on the right.



3. Which letter represents the mineral that would crystallize at the highest temperature?

4. Which letter is closest to the location of muscovite on the diagram?

5. Which letter represents a composition of plagioclase feldspar?

6. A geologist's definition of a mineral includes all but one of the following characteristics. Which one is the exception? (A) naturally occurring; (B) exhibits cleavage; (C) crystalline substance; (D) definite chemical composition; (E) inorganic.

7. Which sequence of geologic time intervals proceeds from most ancient to most recent? (A) Cretaceous – Tertiary – Quaternary – Cambrian; (B) Precambrian – Devonian – Cretaceous – Tertiary; (C) Paleozoic – Cenozoic – Mesozoic – Proterozoic; (D) Oligocene – Pleistocene – Pliocene – Paleocene.

8. Which one of the following sedimentary rocks would be deposited nearest to the sediment source? (A) shale; (B) rock salt; (C) limestone; (D) conglomerate.

9. Which one of the following terms best describes a high-grade, foliated metamorphic rock? (A) poorly sorted; (B) slaty cleavage; (C) gneissic banding; (D) graded bedding; (E) permineralized.

10. Which fine-grained clastic sediment is deposited in a low-energy environment far from its source? (A) conglomerate; (B) limestone; (C) shale; (D) rhyolite; (E) schist.

11. Which one of the following ages is closest to the age of final extinction of dinosaurs? (A) 6 million years; (B) 65 million years; (C) 306 million years; (D) 660 million years.

12. All but one of the following are laws (or principles) of stratigraphy. Which one is the exception? (A) law of superposition; (B) law of crosscutting relationships; (C) principle of faunal succession; (D) principle of constant dip; (E) principle of original horizontality.

13. Of the following, the best candidate for a parent rock to arkose is: (A) schist; (B) limestone; (C) peridotite; (D) granite; (E) shale.

14. In a road cut through sedimentary rocks in west Texas you observe that grain size decreases in going from lower (older) beds to higher (younger) beds. Which one of the following is the best geologic interpretation? (A) There must be a normal fault nearby. (B) The energy of the depositional environment

decreased with time. (C) The rocks are of Precambrian age. (D) The energy of the depositional environment *increased* with time. (E) None of the preceding conclusions makes geologic sense.

TOPOGRAPHIC MAPS (15 points)

15. "1 inch = 2000 feet" expresses what kind of map scale? (A) verbal scale; (B) ratio scale; (C) bar scale; (D) bathroom scale; (E) contour scale.

16. Which one of the following best describes the significance of Greenwich, England to global positioning? (A) It is at 0° longitude. (B) It is the topographically highest point in England. (C) It is at 0° latitude. (D) The International Date Line passes through Greenwich, England.

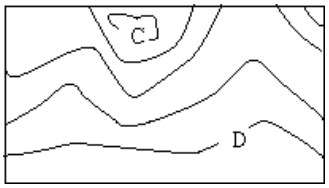
17. Which one of the following topographic map terms refers to a line connecting points that are all at the same elevation? (A) contour line; (B) line of longitude; (C) drainage line; (D) line of latitude.

18. Which one of the following is a possible latitude and longitude of a locality in North America? (A) 30° North, 45° South; (B) 110° North, 81° West; (C) 45° North, 118° West; (D) 50° North, 90° East; (E) 35° South, 165° East.

19. How are topographic contour lines arranged where they cross a stream? The contour lines: (A) form a "V" that opens in the upstream direction; (B) form a "V" that opens in the downstream direction; (C) do not deviate in the vicinity of the stream; (D) cross one another at the stream; (E) must be widely spaced.

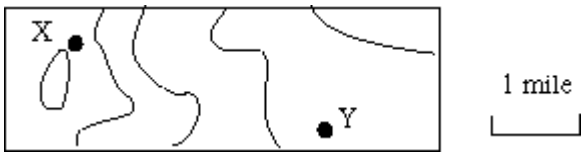
20. What type of distortion is introduced into a topographic profile that is vertically exaggerated? (A) Topography is shown in less detail. (B) Slopes appear to be flatter than they actually are. (C) Contour lines are made to "V" downstream. (D) Slopes appear to be steeper than they actually are. (E) No type of distortion is introduced by vertical exaggeration of a topographic profile.

21. Refer to the topographic map, in which points *C* and *D* lie directly upon contour lines. What is the vertical relief between these two points? (A) 100 feet; (B) 200 feet; (C) 400 feet; (D) not possible to determine from the map data.

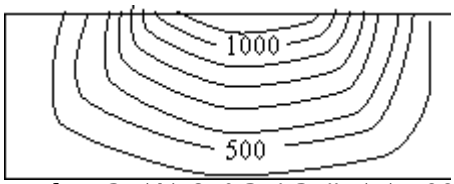


22. A map drawn to which one of the following scales would show the greatest amount of detail? (A) 1:10; (B) 1:400; (C) 1:24,000; (D) 1:100,000.

23. Refer to the topographic map at the right. What is the distance on the ground from point *X* to point *Y*? (A) 1 mile; (B) 2 miles; (C) 3 miles; (D) 10 miles.



24. Refer to the topographic map at the right. What is the contour interval of this map? (A) 20 ft; (B) 50 ft; (C) 100 ft; (D) 500 ft; (E) 1000 ft.



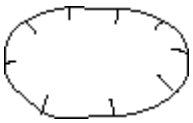
25. Which one of the following is the expression of a gradient? (A) 97° 34' 37"; (B) 500 feet; (C) 50 feet per mile; (D) 1 cm = 1 km; (E) 1:12,000.

26. Which one of the following indicates a very steep slope? (A) contour lines widely spaced; (B) contour lines that "V" upslope; (C) lines of latitude; (D) contour interval = 100 feet; (E) contour lines closely spaced.

27. Which one of the following is the elevation of the beach at Galveston Bay? (A) 1:24,000; (B) zero feet; (C) 240 km; (D) 1 cm = 5 km; (E) gradient.

28. Which of the following scales would remain correct if a topographic map were photographically enlarged or reduced? (A) verbal scale (e.g., 1 inch = 2000 feet); (B) ratio scale (e.g., 1:100); (C) bar scale; (D) horizontal scale. (E) All of the preceding scales would remain correct.

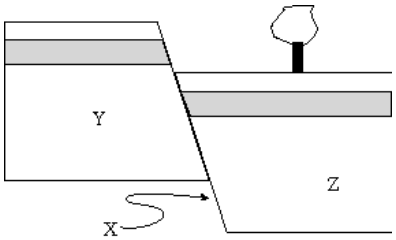
29. The drawing to the right represents which one of the following topographic features? (A) the peak of a hill; (B) a drainage; (C) a flat surface; (D) a closed depression. (E) The drawing does not display a standard topographic map symbol.



STRUCTURE (29 points)

30. Plunging folds: (A) are a result of tensional stress; (B) are anticlines without exception; (C) form U- or V-shaped outcrop patterns in map view; (D) are a manifestation of brittle deformation.

Questions 31 and 32 pertain to the cross section.



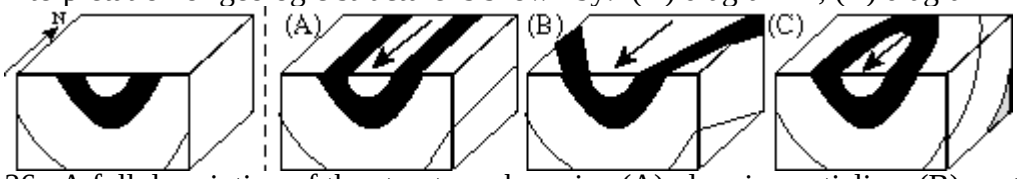
31. Which one of the following terms best describes feature *Z*? (A) hanging wall block; (B) right-lateral strike-slip fault; (C) footwall block; (D) normal dip-slip fault; (E) compression.

32. What is the name of feature *X*? (A) normal dip-slip fault; (B) left-lateral strike-slip fault; (C) right-lateral strike-slip fault; (D) reverse dip-slip fault.

33. A fold in which the limbs dip towards the fold axis but at different dip angles is called: (A) an asymmetrical syncline; (B) an asymmetrical anticline; (C) a symmetrical syncline; (D) a symmetrical anticline.

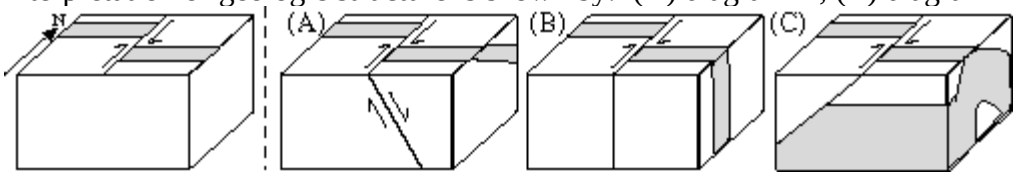
34. If you were to walk upon a dipping bed in the direction of its strike, you would: (A) ascend in elevation; (B) descend in elevation; (C) remain at the same elevation; (D) follow the line of steepest descent.

35. In the three-dimensional block diagrams below, the left-handmost diagram shows a portion of a geologic structure. Three diagrams to the right of it are interpretations of the total structure. The correct interpretation of geologic structure is shown by: (A) diagram A; (B) diagram B; (C) diagram C.



36. A full description of the structure above is: (A) plunging anticline; (B) south-plunging anticline; (C) plunging syncline; (D) south-plunging syncline; (E) north-plunging syncline.

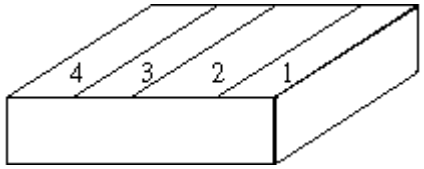
37. In the three-dimensional block diagrams below, the left-handmost diagram shows a portion of a geologic structure. Three diagrams to the right of it are interpretations of the total structure. The correct interpretation of geologic structure is shown by: (A) diagram A; (B) diagram B; (C) diagram C.



38. The complete name of the fault above is: (A) left-lateral strike-slip fault; (B) right-lateral strike-slip fault; (C) normal dip-slip fault; (D) reverse dip-slip fault; (E) thrust dip-slip fault.

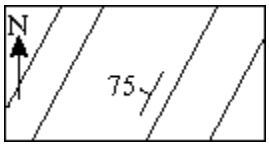
39. Which of the following statements pertains to normal faults? (A) In a normal fault, the footwall block moves relatively up. (B) A normal fault results from compressional stress. (C) Slickensides are horizontal in the plane of a normal fault. (D) Both answers A and B are correct. (E) Both answers B and C are correct.

40. Note: by convention, stratum 1 is the oldest, stratum 2 is younger, etc. In the block diagram, if the age of stratum 4 is Devonian, what is the age of stratum 1 amongst the following choices? (A) Pennsylvanian; (B) Ordovician; (C) Quaternary; (D) Triassic; (E) Cretaceous.

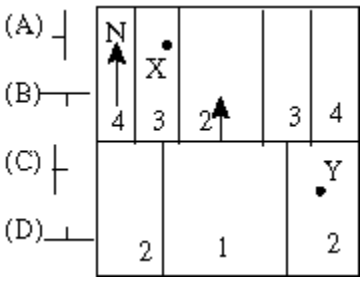


41. Which of the following statements pertains to strike-slip faults? (A) A strike-slip fault results from shear stress. (B) In a strike-slip fault, the footwall block moves relatively down. (C) Slickensides are horizontal in the plane of a strike-slip fault. (D) Both answers A and C are correct.

42. Which is the correct strike and dip for the strata depicted in the geologic map on the right? Strike, dip: (A) N30°W, 75°NW; (B) N-S, 75· NW; (C) N75°E, 45°NW; (D) N30°E, 75°NW; (E) N60°W, 75°SW.



Questions 43 to 47 relate to the map showing strata cut by a fault. From older to younger, the strata are numbered 1, 2, etc.



43. At the dot labeled *X*, which one of the following is the correct strike and dip? (A) symbol A; (B) symbol B; (C) symbol C; (D) symbol D.

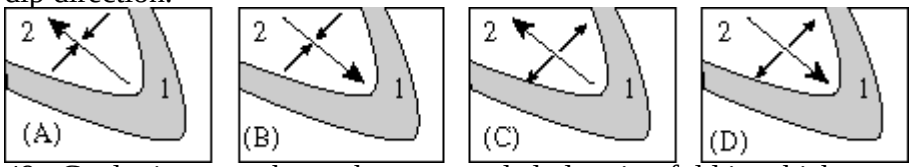
44. At the dot labeled *Y*, which one of the following is the correct strike and dip? (A) symbol A; (B) symbol B; (C) symbol C; (D) symbol D.

45. On the diagram, which half of the block is the hanging wall side? (A) northern half; (B) southern half.

46. What kind of fault is shown on the diagram? (A) normal; (B) reverse; (C) thrust; (D) right-lateral strike-slip; (E) left-lateral strike-slip.

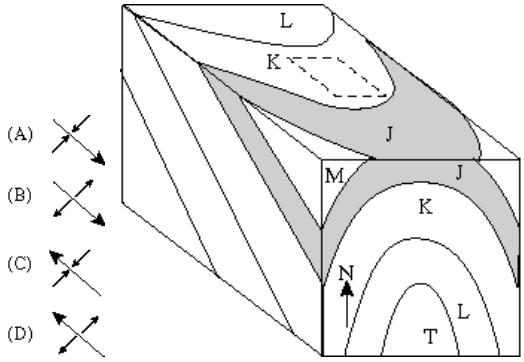
47. On the diagram, which one of the following structures is broken by the fault? (A) plunging anticline; (B) plunging syncline; (C) non-plunging anticline; (D) non-plunging syncline.

48. Which one of the following statements pertains to strike and dip? (A) Strike and dip are oriented in the same direction. (B) Strike and dip are oriented in opposite directions (example: strike NE and dip SW); (C) Strike direction is oriented 90 degrees from dip direction. (D) Strike direction is unrelated to dip direction.



49. Geologic maps above show an eroded plunging fold in which stratum 1 is the older. Which map symbol correctly indicates a plunging syncline? (A) map A; (B) map B; (C) map C; (D) map D.

Questions 50 to 52 refer to the block diagram.



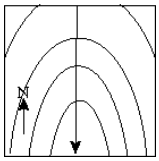
50. The geologic structure is best described as a: (A) plunging anticline; (B) basin; (C) dome; (D) plunging syncline.

51. The oldest layer is labeled as: (A) "*M*"; (B) "*T*"; (C) "*J*"; (D) "*K*"; (E) "*L*".

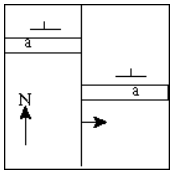
52. Which one of the symbols to the left of the diagram should be placed inside of the dashed rectangle on the upper surface of the block? (A) symbol A; (B) symbol B; (C) symbol C; (D) symbol D.

Diagrams below, in which stratum 1 is oldest, are map views of strata whose structures are exposed at the earth's surface by erosion.

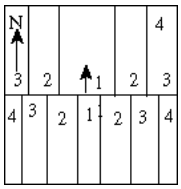
53. The structure is a: (A) south-plunging anticline; (B) south-plunging syncline; (C) north-plunging anticline; (D) north-plunging syncline.



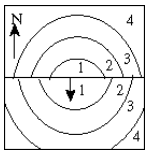
54. The structure is a: (A) left-lateral strike-slip fault; (B) doubly plunging anticline; (C) normal fault; (D) reverse fault.



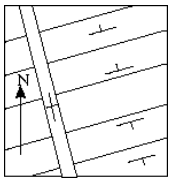
55. The structure is a: (A) reverse-faulted syncline; (B) normal-faulted syncline; (C) reverse-faulted anticline; (D) normal-faulted anticline.



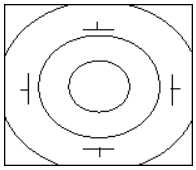
56. The structure is a: (A) reverse-faulted syncline; (B) normal-faulted syncline; (C) normal-faulted basin; (D) reverse-faulted dome.



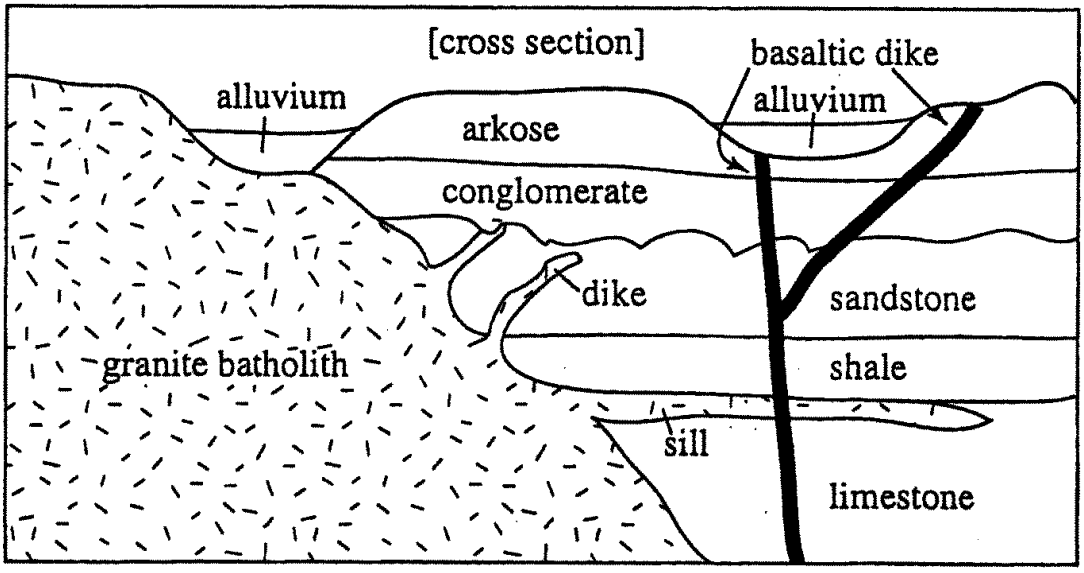
57. The structure is a: (A) vertical dike cutting an anticline; (B) vertical dike cutting a syncline; (C) horizontal dike cutting a basin; (D) horizontal dike cutting an anticline.



58. The structure is a: (A) dome with the oldest stratum at the center; (B) dome with the youngest stratum at the center; (C) basin with the oldest stratum at the center; (D) basin with the youngest stratum at the center.



Questions 59 to 63 refer to the geologic cross section.



59. There is a disconformity between which two rock types? (A) basaltic dike and sandstone; (B) shale and sill; (C) granite batholith and alluvium; (D) sandstone and conglomerate.

60. From most ancient to most recent, which one of the following is a correct sequence of ages of rock units? (A) sill, sandstone, conglomerate, basalt dike; (B) sandstone, sill, conglomerate, basalt dike; (C) sandstone, conglomerate, basalt dike, sill; (D) basalt dike, sill, sandstone, conglomerate.

61. What geologic principle tells us that the arkose is younger than the conglomerate? The law (or principle) of: (A) original horizontality; (B) cross-cutting relationships; (C) faunal succession (D) superposition.

62. If the shale is Silurian and the conglomerate is Triassic, which one of the following is a possible age for the sandstone? (A) Jurassic; (B) Ordovician; (C) Devonian; (D) Quaternary; (E) Precambrian.

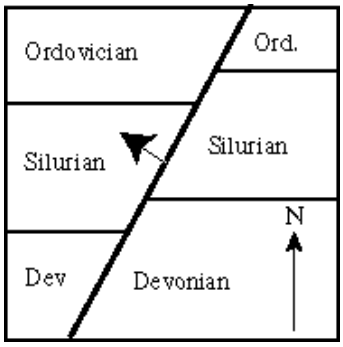
63. From most ancient to most recent, which one of the following is a correct sequence of ages of rock units? (A) limestone, shale, granite batholith, alluvium; (B) limestone, shale, alluvium, granite batholith; (C) granite batholith, limestone, shale, alluvium; (D) alluvium, limestone, shale, granite batholith;

64. An unconformity represents: (A) a gap in the geologic record of sedimentary deposition; (B) a time when the area lay below sea level, receiving sediment; (C) a time of erosion or non-deposition. (D) Both answers *A* and *C* are valid. (E) None of the preceding answers is valid.

65. If eroded strata are dipping in normal fashion (not overturned), they dip in the direction toward the outcrop of: (A) younger strata; (B) the axial plane of an anticline; (C) older strata; (D) higher elevation.
66. The symbol ⊕ on a geologic map indicates: (A) top of a dome; (B) the hanging wall of a fault; (C) horizontal beds; (D) a closed basin.

67. In a certain region, the depositional contacts of strata are closely parallel to topographic contour lines. These strata are arranged as: (A) perpendicular beds; (B) non-plunging folds; (C) plunging folds; (D) horizontal beds.

68. In the geologic map on the right, a fault intersects the level surface of the earth, and slickensides on the fault plane are vertical. It is a: (A) reverse fault; (B) normal fault; (C) left lateral strike-slip fault; (D) right lateral strike-slip fault.



69. Refer to the map on the right. What is the fault if its slickensides are horizontal? (A) reverse; (B) normal; (C) left lateral strike-slip; (D) right lateral strike-slip.

70. A fault indicated by the symbol on the right is a: (A) thrust fault formed by compression; (B) thrust fault formed by extension; (C) normal fault formed by compression; (D) normal fault formed by extension.

FIELD TRIP IN AUSTIN (11 points)

71. The Mount Bonnell Fault is a _____ fault that likely formed under _____ stress. (A) reverse, compressional; (B) reverse, extensional; (C) normal, compressional; (D) normal, extensional.

72. All but one of the following statements concerning the rocks on Mount Bonnell are correct. Which one is the exception? (A) The strata are very nearly horizontal. (B) They are made of limestone. (C) Sediment was deposited in a vast, shallow Cretaceous sea. (D) The rocks are folded into a northwest-plunging anticline.

73. "There is geologic evidence that continued movement on the Mount Bonnell Fault system poses an earthquake hazard to Austin residents." This statement is: (A) definitely correct; (B) definitely incorrect; (C) impossible to evaluate because active or dangerous faults do not give signals about their behavior.

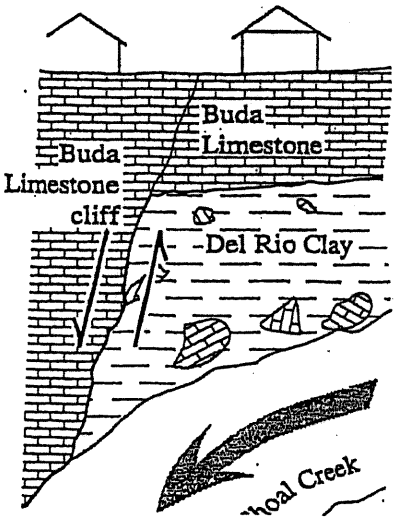
74. What is the geologic evidence regarding timing of the most recent movement on the Mount Bonnell Fault? (A) the acid test; (B) Colorado River terrace deposits; (C) the Cretaceous seaway; (D) vegetation.

75. Which one of the following is the most likely cause for the extensional faulting seen around Austin? (A) loading the earth's crust by construction of buildings in Austin; (B) deposition of sediment in the Gulf of Mexico; (C) compression caused by continental collision; (D) downcutting of the Colorado River.

76. Where does the Mount Bonnell Fault cross under the Colorado River in relation to the Mount Bonnell overlook? (A) downstream (south) between Mount Bonnell and Tom Miller Dam; (B) upstream (north) between Mount Bonnell and the Loop 360 arch bridge; (C) immediately at the foot of Mount Bonnell, passing beneath the homes at the shore. (D) The crossing locality is not visible from Mount Bonnell.

77. At the Shoal Creek stop, we observed a _____ fault for which the displacement is approximately _____ feet. (A) reverse, 10; (B) transform, 50; (C) normal, 40. (D) There is no offset on the fault at Shoal Creek.

For questions 78 through 81, use the diagram of the geological relationships seen at Shoal Creek (Stop 2), and arrange the following events from youngest to oldest.



(A) downcutting of modern valley by Shoal Creek
(B) regional uplift above sea level, accompanied by normal faulting
(C) deposition of the Del Rio clay, then the Buda limestone
(D) beveling of fault scarp as an ancestral stream cut laterally

78. ___ most recent (youngest) event
79. ___
80. ___
81. ___ most ancient (oldest) event

HYDROGEOLOGY (12 points)

For questions 82 through 85, match the phrase with the correct word.

82. The ease with which water can flow through a porous medium

83. Aquifer that supplies groundwater to the Texas Panhandle, recharges through diffuse flow

84. Fractured limestone aquifer that supplies water to San Antonio

85. Place where groundwater comes to the surface and is released

(A) Edwards aquifer
(B) discharge
(C) permeability
(D) Ogallala aquifer

86. The fraction of the volume of a material that consists of empty space is termed its: (A) permeability; (B) porosity; (C) fracture; (D) void.

87. True or false? A rock that has high porosity necessarily also has high permeability. (A) true; (B) false.

88. Through which aquifer would contaminated groundwater flow most rapidly? (A) alluvial aquifer; (B) fractured aquifer; (C) confined shale aquifer; (D) unconfined shale aquifer.

89. All but one of the following are consequences of building impervious cover such as paved parking lots. Which one is the exception? (A) increased the rate of recharge through the ground; (B) increased rate of runoff; (C) increased potential for flooding; (D) decreased rate of recharge through the ground.

90. Which one of the following is an example of primary porosity? Open space: (A) among sand grains when deposited; (B) in a cave; (C) in a fault fracture; (D) created by solution of limestone.

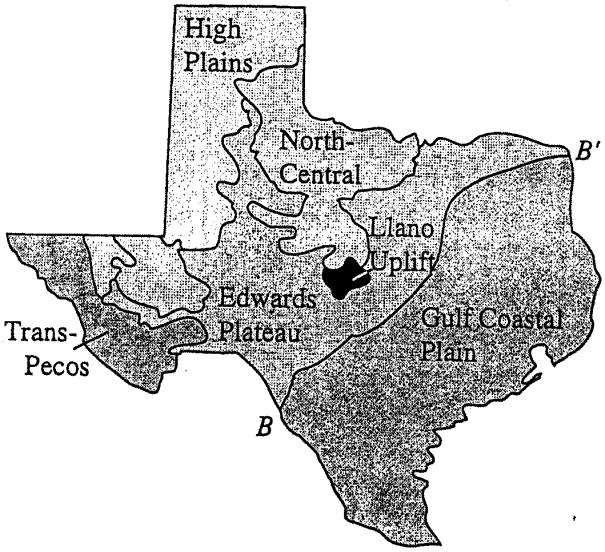
91. All but one of these characteristics pertain to the Edwards aquifer. Which one is the exception? (A) fractured; (B) high rates of recharge along focused flow paths; (C) associated with karst topography; (D) slow movement of groundwater along diffuse pathways.

92. Which one of the following is a good example of an aquitard? (A) fractured limestone; (B) shale or clay; (C) uncemented sandstone; (D) coquina.

93. True or false? When the rate of pumping exceeds the rate of recharge, the water table in an unconfined aquifer drops lower. (A) true; (B) false.

GEOLOGY OF TEXAS (7 points)

All of the remaining questions pertain to the map showing geologic provinces of Texas.



94. Line *B* on the map represents the: (A) Rocky Mountains; (B) Balcones fault zone; (C) eroded, buried Ouachita Mountains. (D) Both answers B and C are correct.

95. Line *B* on the map also represents the: (A) edge of the Ogallala aquifer; (B) edge of the ancient North American continent; (C) edge of the continent in the Quaternary Period; (D) Colorado River.

96. Which one of the following geologic features is characteristic of the Llano Uplift? (A) basalt lava flows; (B) sandstone laccoliths; (C) granite batholiths; (D) kilometers thick accumulation of sediment.

97. The Edwards Plateau is underlain by: (A) limestone; (B) basalt; (C) sandstone; (D) shale.

98. In late Paleozoic time, rivers in north-central Texas flowed: (A) into the Pacific Ocean; (B) westward into an inland sea positioned in New Mexico and west Texas; (C) southeast into the Gulf of Mexico; (D) north to the Arctic Ocean.

99. Which one of the following geologic features is characteristic of the Gulf Coastal Plain? (A) granite batholiths; (B) Tertiary volcanic deposits; (C) thick sedimentary basin deposits (deltas); (D) high-grade metamorphic rocks.

100. Mountain ranges are located in what area of Texas? (A) Llano Uplift; (B) High Plains; (C) Trans-Pecos region; (D) Gulf Coastal Plain.