Scioly Summer Study Session 2018-2019

Geologic Mapping

Test Packet

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Instructions

1) This test is based on the 2016 rules for Geologic Mapping.

2) This test is out of 115 points. Questions are worth one point unless otherwise indicated in parentheses next to the question.

3) Tiebreakers, in order of evaluation: 3, 9, 10, 11, 15, 19, 20, 24, 26, 27, 34, 41, 45, 50, 51, 52, 56, 58, 60

4) The space provided for each question is sufficient for a response earning full points (although in most cases, there is more space available than is necessary).

5) For calculation or measurement questions, answers in an acceptable range will earn full points. Significant figures are irrelevant so long as the answer is within range.

6) For both questions and answers, strike convention on this test will be 180-degree true-north azimuth form, and dip convention will be in degrees from horizontal with a directional indicator. When paired, strike is listed first.

Team Name __________________________________________________

Name(s) ___________________________________________ ________________________________
1. ______________ What type of fault is shown in the left image?
2. ______________ Is this fault dextral or sinistral?
3. Draw the other type of fault from the previous question in the space below.

4. _______ Consider that the road in the image at left is 10 meters wide. If the fault’s rate of motion is 14 cm/year, how long ago in years did the fault form? (2)
5. _______ The fault shown in the right image is a dip-slip fault. What specific type of dip-slip fault is this?
6. _______ If the river in the image is formed from the tributary shown, and flows north, what is the dip direction of the fault to the nearest multiple of 90?
7. _______ If the vertical displacement of the fault is 18 meters and the slope is 23.5 meters long, what is the dip of the fault plane? (2)

8. _______ You encounter a perfectly vertical cliff (dip of 90) with a measured strike of 90 (assume that the exposed cliff face is at north). A bedding plane cuts through the cliff – from previous measurements, you know that this plane has a strike and true dip of 20-W35 (that is, strike 20 and true dip W35). What is the apparent dip of the bedding plane as seen in the cliff face? (2)
9. _______ You measure the width of the bedding plane as seen in the cliff face at 20 centimeters. Based on the information from the previous question, what is the true thickness of the bedding plane in meters? (3)
10. _______ Consider instead that the cliff face has a dip of N75. Assume that the thickness on the cliff face is still measured at 20 cm (i.e. this stratum has a different true thickness). Recalculate question 9. (2)
11. _______ Consider a stratum with dip of 16 degrees, and striations with a rake of 78 degrees. What is the plunge of the striations in degrees? (2)
Refer to the fictional topographic map below for questions 12-20. The map is 2 km on each edge.

12. ______ Letters A, B, and C are mountain peaks. Which of these is the tallest?
13. ______ Mountains A and C are at heights of 3562 m and 3523 m respectively. Calculate the map’s contour interval.
14. ______ Based on the information from the previous question, about how tall is Mountain B in meters?
15. Give two possible elevations for Contour D. Based on the topography, which one is more likely? Why? (3)
   ______ / ______; ______; ______

16. There are three tributaries in the topographic map, which merge all at once to form a single stream. Draw these streams, from their formation until they exit the eastern edge of the map, with a colored pencil. (4)
17. ______ What is the approximate elevation of the merging point of the tributaries?
18. Mark the location of the tallest steep cliff shown on the map with an X.
19. ______: ______ The red dots mark the locations of three outcrops of a (thin, planar) stratum.
   Calculate the approximate strike and dip of the stratum. You do not need to give a dip direction. (4)
20. ______ How tall in meters would Mountain A need to be for this stratum to outcrop at the peak? (2)
21. _______ What is the contour interval of this topographic map? (the labeling is in feet)
22. _______________ What geographic feature is located at point A?
23. Mark with an X the mouths of the three west-flowing tributaries that feed the river at the west. (3)
24. Draw the path of the stream that drains the eastern slope of Smith Walker Mountain until the point where it exits the eastern edge of the map. (5)
25. The uniform steep slope off the western edge of Stoneman Mountain dips at an angle of 26 degrees. How far, in feet, is the horizontal distance between the peaks of Mars Mountain and Little Mountain? (3)
26. Draw a topographic profile between Little Mtn (left) and Mars Mtn (right). Label elevations at multiples of 200 ft along the left side of the profile, and label distances from left to right in multiples of 1000 ft. (6)
Refer to the fictional cross-section below for questions 27-35. Assume significant vertical exaggeration.

27. Order the letters representing each layer or other feature from oldest to youngest. (6)
   Oldest _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Youngest
28. _______________ Is the fault marked by the number 1 synthetic, antithetic, or neither?
29. _______________ What type of fault is J? (1) _______________ What type of fault is G? (1)
30. _______________ What type of unconformity is L?
31. _______________ What type of structure is E?
32. _______________ A thrust fault is primarily caused by what type of stresses?
33. _______________ A collection of thrust faults and associated deformation is known as what?
34. _______________ The formation from the previous question occurs near what type of plate boundary?
35. _______ Assume that the strata colors in the image correspond to standard USGS recommendations.
   Fault J is most likely to be associated with which of these?
   A. Appalachian orogeny
   B. Canadian shield
   C. Laramide orogeny
   D. Formation of Rodinia
For questions 36-40, each question has one or more correct answers – choose all that apply.

36. ______________ The Mercator map projection (2)
   A. Plots longitude and latitude lines in parallel to each other
   B. Preserves angular measurements
   C. Preserves area measurements
   D. Is centered on a pole

37. ______________ The Mollweide map projection (2)
   A. Plots longitude and latitude lines in parallel to each other
   B. Preserves angular measurements
   C. Preserves area measurements
   D. Is centered on a pole

38. ______________ A Schmidt net (2)
   A. Plots planar features as straight lines
   B. Plots great circles as straight lines
   C. Plots linear features as points
   D. Preserves area

39. ______________ Dip isogons (2)
   A. Are formed using lines normal to the fold surface
   B. Classify folds into 2 major types
   C. Are formed using lines of equal dip
   D. Can be divergent, convergent, or similar/axial

40. ______________ Divergent plate boundaries (2)
   A. Often produce mid-ocean ridges
   B. Often produce rift valleys
   C. Often produce island arcs
   D. Often produce transform faults

41. Draw in the sides of the block diagram below. (2)

42. ______________ What type of geologic feature is shown in the block diagram above?

43. ______________ Is the feature shown above a syncline or an anticline?
Refer to the (real) geologic map below for questions 44-52. The straight line is a cross-section mark for A-A’.
44. __________________; __________________ What does the “Q” in Qal mean? What does the “al” mean? (2)
45. __________________ Based on your answer to the previous question, what geographic surface feature is most likely found on the part of the map near the word “Boulder”?
46. ______ What is the contour interval of this map? (the map is marked in feet)
47. What is the dotted line just below the word “Boulder”? Why is it dotted? (2)

48. __________________ Consider the small outcrop of Kqm. Approximately what range of elevations does it span?
49. Consider the two long north-south faults near the eastern edge of the map. In roughly which primary cardinal direction do these faults dip? Are these faults normal or reverse?

50. __________________; What geologic feature produced the western outcrops of Ka?
51. What type of stress is primarily affecting the area shown in the map? How do you know? (2)

52. Draw a cross-section of A-A’ from left to right below. Include approximate topography and geology – mark units with the appropriate letters. Label the vertical axis in multiples of 200 ft. Note – Kg is the basement geologic unit in the west, and Kgp is the basement unit in the east. (8)

53. What is the difference between a syncline/anticline and a synform/antiform? What would a synformal anticline or antiformal syncline indicate about the relevant strata? (2)

54. __________ You encounter a stratum while walking northward up a steep slope. The slope dips toward you at 33 degrees, while the stratum dips toward you at 19 degrees. The stratum has a visible width of 5.2 meters, as measured along the slope. What is the true thickness of the stratum in meters? (2)

Use a stereonet for questions 55-60. Attach the piece of tracing paper you used to answer the questions. Plots within a reasonable distance of the exact attitude will be scored as correct.
55. Mark the outer circle of the net and label the 000 strike line on your tracing paper.
56. Mark on your tracing paper a bedding plane with attitude 015-E12.
57. Mark a lineation on the plane from the previous question with a rake of 35 degrees and directed northeast.
58. ________ What is the plunge of the lineation from the previous question?
59. Mark a second bedding plane with attitude 0110-S50.
60. ________; ________ What is the trend and plunge of the intersection between the two bedding planes? (2)

The End