Pennsylvania States

Geologic Mapping

Don't Be Stupid – You Know the Rules
You're Here for a Reason...
You're Here because you're good!
Don't Make me Enforce said Rules ☺

If you EVER have any questions, EVER,
Just ASK. It's that simple
(Studies have shown that I don't bite, often)

NO Answers in the Test Packet will count.
Only Answers on the Answer Sheet will be graded!

Name(s): _____
School: _____
Team: _____

(Fake) EXTRA-CREDIT QUESTION!!!!
(Disclaimer: Not Actually Worth Extra-Credit! Hence the word "Fake")
How many Pet Rocks does it take to change a Lightbulb?

_____

*Look at **Figure 1** for questions 1-6.*

1. Sketch a line that accurately and clearly shows the principle fault line at the above location. *(Hint: Barbados is 100% coral.)* **(2)**

2. What type of boundary is present? **(1)**

3. What is the most prominent type of faulting that may occur? **(1)**

4. Recall what the proper symbol is to show the boundary that is present here. With your answer from #1, add the symbol(s) in its appropriate spot. **(1)**

5. Explain how the island chain that includes Grenada, St. Lucia, Martinique, etc, formed. What is the name given to this feature? **(2)**

6. If you couldn't tell, what you see in Figure 1 is a satellite image of the Lesser Antilles. To the northern portion of the Lesser Antilles, there seems to be two different island chains. What is the Relative Age of the western island chain verses the eastern island chain? *(Older, younger, same?)* **(2)**

*Look at **Figure 2** for question 7*

7. Liquid hazardous waste is often disposed of by pumping it down injection wells. Which well location would have the lowest chance for the injection well to contaminate surface water? **(2)**

*Use the information below and **Figure 3** to answer questions 8-9*

Most people, including residents of the Bay Area, do not know that a significant amount of the land around the San Francisco Bay is actually land-fill, whether for residential or industrial purposes. Around most of the bay, anywhere from 1-5km is land-filled earth. Therefore, almost all buildings on the edge of the bay are actually not on original San Francisco soil!

8. Using Figure 3, which lettered point would be most susceptible to liquefaction? **(2)**

9. What geologic hazard is most likely to cause liquefaction? **(2)**

*Refer to the information below and **Figure 4** & **Figure 5** for questions 10-11*

Figure 5 shows a section of a Geologic Map of Chief Mountain in Glacier National Park in North West Montana. Figure 4 shows the relative age timeline for bedrock strata. Below the rock that is shown on the map is rock from the Cretaceous Period. Although you can't see it in the figure, recognizing it is there is all that matters. Chief Mountain is composed of layers of Dolomite, Sandstone, and Limestone.

10. What is the symbol for the oldest rock that is **seen** in figure 5? **(1)**

11. Using Figure 4 & 5, explain how the rock that composes Chief Mountain got there and why there is Cretaceous rock below? *(Hint: Think about how Western North America formed geologically)* **(4)**

12. Speaking of the Cretaceous Period, what extremely significant event occurred approximately 65-66 Ma? **(2)**

*Refer to the information below and **Figure 6** for questions 13-15*

Figure 6 shows a picture of the North Western Region of Washington State. There are two mountain ranges in the figure, the volcanic Cascade Mountains and the non-volcanic Olympic Mountains.

13. Which mountain range is the most east? **(1)**

14. Both the Olympic and Cascade Mountains formed due to plate subduction. Based on how the Olympic Mountains were formed, what is the name of the feature that best describes what the Olympic Mountains are? *(The Answer is not "Mountains")* **(2)**

15. At the subduction zone that created the two mountain ranges, what is the name of the plate that subducted below the North American Plate? **(2)**

16. Looking at ***Figure 7***, which letter corresponds to a regime of contact metamorphism? *(Hint: Think about where you would find contact metamorphism).* **(3)**

*Refer to **Figure 8** for questions 17-18*

17. Looking at Figure 8, what feature is shown? **(1)**

18. Explain where you would find the oldest rock in the feature. **(2)**

19. What Era is often referred to as the "Age of Reptiles" where Reptiles filled almost every ecological niche? **(2)**

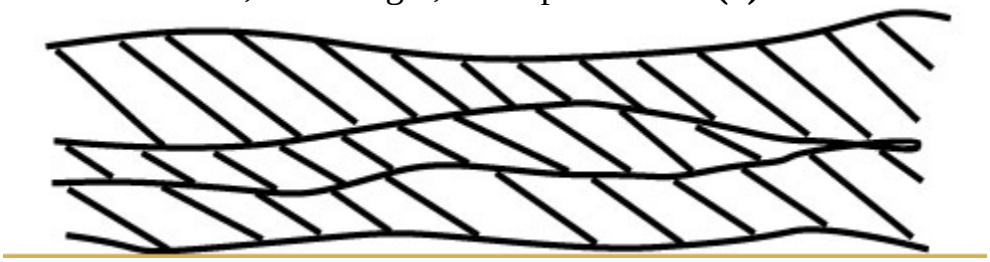
*Refer to the information below and **Figure 9** for questions 20-21*

Figure 9 shows 3 Stratigraphic Columns from 3 different National Parks, all within the same 200km circle. These columns only show exposed rock.

20. Using Figure 9, rank the following formations from Youngest to Oldest.
(1/2 point per correct, +1 points for all correct, 5 total)

-Carmel Fm	-Wasatch Fm	-Winsor Fm	-Kaibab Ls
-Navajo Ss	-Vishnu Schist	-Moenkopi Fm	-Tropic Shale

21. In the figure below, cross-bedding is seen in a sandstone environment. Which direction, left or right, is the paleoflow? **(2)**



Questions 22-26 are all related somehow. Use knowledge about Plate Tectonics and Geologic History to answer the questions.

22. Mount Everest, in the Himalayan Mountain Range, formed due to what type of boundary? **(1)**

23. What two tectonic plates are involved in the creation of the Himalayan Mountain Range? **(2pts, 1 per plate)**

24. Limestone, a sedimentary rock composed primarily of $CaCO_3$, most commonly forms under what conditions? **(2)**

25. Fun Fact: There is Limestone atop Mount Everest. How could Limestone be on top of Mount Everest? Be sure to explain where and when (relatively) it formed. *(Hint: It didn't form there).* **(5)**

26. On a geologic map, you notice a Limestone strata with a strike of 000. At the outcrop furthest to the west, the elevation is 277m. This is marked as M_1. A measurement taken 400m due east of M_1 measures 281m. This is marked as M_2. A final measurement taken at the furthest east outcrop of the Limestone strata measures 285m, marked M_3. M_3, is 400m due east of M_2. The Limestone strata has a dip of 6°. What is the True Thickness of the Limestone strata? **(4)**

27. Slickensides Oligoshian Formation pitch 60°N on a fault oriented at 335°, 60W. What is the Plunge of the Slickensides? **(7)**

28. A shale is measured at two different points, yielding two apparent dips measuring (plunge, trend) 30°, S20W, and 15°, S50E. What is the Strike and True Dip of the shale, given the two apparent dips measured? *(Give Strike as an Azimuth, and True Dip as a degree in Dip Direction)* **(5,5, 10 total)**

29. On a USGS 7 1/2-minute topographic quadrangle, you notice two UTM ticks, $^{6}26$ and $^{6}29$. What is the (real-life) distance, in meters between the two mentioned delineations? **(3)**

30. Given the two UTM points below, calculate the distance from A to B in miles. (1mi = 1.6093km) **(3)**

A – 4520293N, 258804W **B** – 4487474N, 752877W

31. When the first event started today, what time was it (locally) in a small fishing village in Russia with a longitude of 33.75 degrees west? **(4)**

Questions 32-38 involve a Stereonet. The stereonet should be done on a blank piece of paper. Please turn in the stereonet with your test! 2 Extra-Credit points will be awarded for putting your Names, Team, and School in the upper right-hand corner of your stereonet paper.

32. Draw the outline of the stereonet and label the Cardinal Directions at their appropriate azimuths. **(2)**

33. Graph a Sandstone Bed with attitude 018°,47°. Label this "Plane A". **(3)**

34. Plot the Pole of Plane A and label it "Pole A". **(2)**

35. Graph a Shale Bed with attitude 128°, 70°. Label this "Plane B". **(3)**

36. Plot the Pole of Plane B and label it "Pole B". **(2)**

37. Draw a line that represents the intersection of Plane A and Plane B. **(1)**

38. On the Stereonet **AND** the Answer Key, give the Orientation (Trend & Plunge) of the intersection. **(3,3, 6 total)**

*Refer to **Figure 10** for questions 39-53*

39. Rank each significant event from Oldest to Youngest. Include "Faulting" and "Folding" in your event sequence in their respective spots. Do not include any numbered events. **(1/2 pt each, +1/2 pts if all correct, 9 total)**

40. Find number 1. What feature is this? **(1)**

41. Find number 2. What feature is this? **(2)**

42. Find number 3. What feature is this? **(1)**

43. Find number 4. What feature is this? *(Multiple Answers Accepted)* **(2)**

44. Find the two wells in the cross-section. Well A is dry and does no flow. Well B does flow and can supply water. What type of aquifer supplies Well B? **(2)**

45. Is there an aquifer in Shale Strata J? If so, what type of aquifer is it? **(2)**

46. Is there an aquifer in Sandstone Strata A? If so, what type of aquifer is it? **(2)**

47. Look at Strata M and Strata N. You will notice there is some igneous rock seen in this cross-section in the strata. What is the name of these intrusions? **(2)**

48. Somewhere in this cross-section, you can find a river bed preserved in the record. Which Strata was the youngest strata during the time when the river flowed? **(2)**

49. What type of Fault is observed in the cross-section? **(2)**

50. What type of Unconformity is seen below Sandstone Strata A? **(2)**

51. What type of force caused the folding of strata C, D, E, F, G, & H? **(2)**

52. Find number 5. Which of the following rocks would most likely be seen here? Diorite, Granite, Pegmatite, Andesite, Peridotite, or Quartzite? **(3)**

53. Coal Seam N formed at the same time as a majority of the coal that is found in Pennsylvania. What geologic Period is it most likely from? **(3)**

(1 more page)

Refer to The Geologic Map Provided of Big Pine Fault for the remainder of the Test.

54. What type of fault is the Big Pine Fault? Be as specific as possible. **(3)**

55. Along the banks of the Cuyama River, there is a lot of alluvium sediment. However, the alluvium sediment stretches further away from the banks in many places to the inside of the "Horseshoe" that is created by the river. Explain why the Younger alluvium sediment stretches over the Morales and Quatal Formation here. **(4)**

56. Find the D to D**'** line on the Geologic Map. With the space left on the Answer Sheet, construct an <u>accurate</u> cross-section from D to the Big Pine Fault (following the D to D**'** line). *(I highly suggest using a protractor).* **(30)**