C - GeoLogic Mapping - Rickards Invitational Div. C - 12-05-2020

Hello there! Welcome to the Rickards Invitational. You have 50 minutes to complete the following test, good luck!

Section 1: Multiple Choice and Fill in the Blank

Answer the following questions below. The question format will be either multiple choice (A-E) or fill in the blank. For the fill in the blank questions, please capitalize every word in you answer.

Good Luck!

1. (1.00 pts) What is the supercontinent that formed after the breakup of the Columbia supercontinent?

- A) Gondwana
- B) Pannotia
- C) Pangaea
- D) Vaalbara
- (●) E) Rodinia

2. (1.00 pts) True or False: Seismic waves pass slowly through the asthenosphere

- (●) A) True
- B) False

3. (1.00 pts) The splitting of what mineral marks the boundary between the asthenosphere and the mesosphere?

- A) Peridotite
- B) Obsidian
- (●) C) Ringwoodite
- D) Granite
- E) Mica

4. (1.00 pts) The discontinuity between the outer and inner core is known as what?

- A) Moho
- B) Repetti
- (●) C) Lehmann
- D) Guttenberg
- E) Conrad

5. (1.00 pts) Who formed the idea that earthquakes spread as waves through the Earth?

- (●) A) John Mitchell
- ( ) B) Nicolas Steno
- ( ) C) Charles Lyell
- ( ) D) James Hutton
- ( ) E) Johann Gottlob Lehmann

6. (1.00 pts) Who first grasped the idea of mantle convection?

- ( ) A) Alfred Wegener
- ( ) B) Abraham Gottlob Werner
- (●) C) Arthur Holmes
- ( ) D) Nicolas Steno
- ( ) E) James Hutton

7. (1.00 pts) Which type of lagoon is marked by its only connection to the main body of water being a thin, narrow strait?

- ( ) A) Restricted
- (●) B) Choked
- ( ) C) Leaky
- ( ) D) Segmented
- ( ) E) Pinched

8. (1.00 pts) Which type of estuaries are formed when a lagoon is separated from the ocean by a barrier island?

- ( ) A) Tide Dominated
- ( ) B) Wave Dominated
- ( ) C) Coastal Plain
- (●) D) Bar-built
- ( ) E) Fjord

9. (1.00 pts) Which type of depositional movement is marked by a gradient of sedimentary rock that is fining upwards?

- ( ) A) Progradational
- ( ) B) Retrogradational
- ( ) C) Regressional
- (●) D) Transgressional
- ( ) E) Aggradational

10. (1.00 pts) Which type of parasequence is marked by a seaward migration of the contact between deeper and shallower facies upwards along the sequence?

- ( ) A) Aggradational
- (●) B) Progradational

C) Regressional
D) Transgressional
E) Retrogradational

11. (1.00 pts) Which type of map projection map the prime meridians as a straight line, other meridians as complex curves, and the parallels as circular arcs?

A) Conical
B) Azimuthal
C) Pseudoconical
D) Pseudoazimuthal
E) Cylindrical

12. (1.00 pts) Which two map properties cannot exist everywhere on the map separately?

A) Area and Distance
B) Shape and Distance
C) Distance and Direction
D) Area and Shape
E) Shape and Direction

13. (1.00 pts)

Which map projection is the image above showing?

A) Eckert II
B) Eckert III
C) Eckert IV
D) Eckert V
E) Eckert VI

14. (1.00 pts) What type of map projection was described in the question above?

A) Cylindrical
B) Azimuthal
C) Conical
D) Pseudoconical
E) Pseudocylindrical

15. (1.00 pts) The United States exists between what two latitude numbers on the UTC map (including Alaska)?

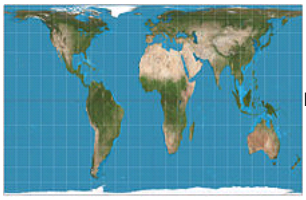
A) 1 and 19
B) 2 and 20
C) 10 and 18
D) 6 and 24
E) 31 and 40

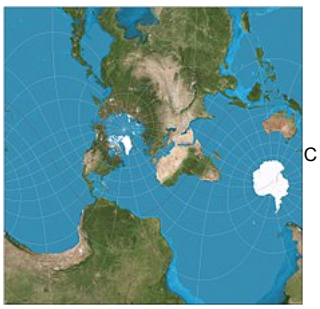
16. (1.00 pts) What is the degree area that the United States takes up on the UTC map(including Alaska)?

A) 108
B) 18
C) 22
D) 132
E) 48

17. (1.00 pts)


A


B


C


D

In terms of projection types, which map projection of the images above does not belong?

A) A
B) B
C) C
D) D

○ E) None of the above (all of them belong)

18. (1.00 pts) Which map projection is used to minimize distortion when displaying all 50 states?

○ A) Mercator
○ B) Mollweide
◉ C) GS50
○ D) Dymaxion
○ E) Armadillo

19. (1.00 pts) What process does Bowen's Reaction Series show?

○ A) Pyroclastic rock formation
◉ B) Fractional crystallization
○ C) Flux melting
○ D) Outgassing
○ E) Exsolution

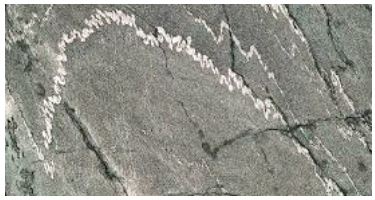
20. (1.00 pts) Which two minerals from Bowen's Reaction Series are most likely to be found together?

◉ A) Olivine and Pyroxene
○ B) Pyroxene and Quartz
○ C) Amphibole and Quartz
○ D) Biotite Mica and Olivine
○ E) Plagioclase Feldspar and Olivine

21. (1.00 pts) When the dip isogons are parallel, what class of dip isogon is this showing?

○ A) Class 1a
○ B) Class 1b
◉ C) Class 2
○ D) Class 1c
○ E) Class 3

22. (1.00 pts)



What fold is the image above showing?

○ A) Chevron
◉ B) Parasitic

C) Monocline
D) Homocline
E) Kink

23. (1.00 pts) What is the upthrown block between two normal faults called?

Horst

24. (1.00 pts) What are faults that occur around calderas called?

A) Listric
B) Synthetic
C) Antithetic
D) Ring
E) Rotational

25. (1.00 pts) What is the deepest layer of an ophiolite sequence made out of?

Peridotite

26. (1.00 pts) What is the third deepest layer of an ophiolite sequence made out of?

Gabbro

27. (1.00 pts) What is the relationship between the speeds between P, S, Rayleigh (R), and Love (L) waves?

A) L < R < P < S
B) R < L < S < P
C) L < R < S < P
D) S < R < P < L
E) P < S < R < L

28. (1.00 pts) What is the zone of seismicity corresponding with the down sliding slab in the subduction zone?

A) Flinn-Engdahl Regions
B) Wadati-Benioff Zone
C) Anderson's Zone of Faulting
D) Subductive Seismic Zone
E) Stoneley Zone

29. (1.00 pts) Which drainage pattern is most likely to occur in areas where there has been a lot of geologic disruption?

Deranged

30. (1.00 pts) Which drainage pattern is most likely to occur down a volcano?

Radial

31. (1.00 pts) What is Death Valley an example of?

- A) Shield
- B) Horst
- C) Graben
- D) Fault
- E) Basin

32. (1.00 pts) Which physiographic province does Tallahassee exist in?

Coastal Plain

33. (1.00 pts) What kind of earthquake occurs along a thrust fault that does not show signs of fracturing on the surface?

Blind

34. (1.00 pts) What is the most abundant silicate in the Earth's crust?

- A) Quartz
- B) Pyroxenes
- C) Feldspar
- D) Amphiboles
- E) Micas

35. (3.00 pts) Which are folding mechanisms? (choose all that apply)

(Mark **ALL** correct answers)

- [ ] A) Tension
- [x] B) Flexural Slip
- [ ] C) Slab Pull
- [x] D) Buckling
- [ ] E) Antiformal Molding
- [x] F) Mass Displacement

36. (1.00 pts) What is produced when there is erosion or normal faulting on a thrust fault?

- A) Shield
- B) Horst
- C) Graben
- D) Fenster
- E) Fault Scarp

37. (1.00 pts) Which field of folding corresponds with a low mean ductility?

- A) Passive
- B) Flexural Flow
- C) Flexural Slip
- D) Quasi-Flexural
- E) Active

38. (1.00 pts) What fold structure represents the connection of many hinges in a folded stack?

- A) Axial Plane
- B) Fold Limb
- C) Crest
- D) Trough
- E) Hinge Stack

39. (1.00 pts) What is the vergence of a fold axial plane that has a strike of N 25° E and a dip at angle of 30° SE?

- A) SE
- B) NE
- C) SW
- D) NW
- E) N

40. (1.00 pts) Which foreland basin depositional zone sits on the moving thrust sheet and contains all the sediments from the active thrust wedge?

- A) Forearc
- B) Fore Deep
- C) Wedge Top
- D) Forebulge
- E) Backbulge

41. (1.00 pts)
You come across a certain depositional sequence and notice significant cross-bedding. You also notice that the sediment contained within the beds ranges from 1-10 cm. Which depositional environment could this sequence have come from?

- A) Glacial
- B) Aeolian

- [x] C) Fluvial
- [ ] D) Lacustrine
- [ ] E) Deep Marine

42. (1.00 pts) If the dip of an axial surface and the plunge of the hinge line are both between 30° and 60°, what can the fold be classified as?

- [ ] A) Upright
- [ ] B) Recumbent
- [ ] C) Vertical
- [ ] D) Horizontal
- [x] E) Reclined

43. (1.00 pts) Which unconformity is defined as being between layers of sedimentary rock and either igneous or metamorphic rock?

- [ ] A) Paraconformity
- [x] B) Nonconformity
- [ ] C) Discontinuity
- [ ] D) Buttress Unconformity
- [ ] E) Blended Unconformity

44. (1.00 pts) What is the angle between a line (or feature) and the strike line of the plane in which it is found called?

Rake

45. (1.00 pts)

You come across the fold outlined in the image above. What type of fold is this?

- [ ] A) Isoclinal
- [x] B) Recumbent
- [ ] C) Homocline
- [ ] D) Similar
- [ ] E) Anticline

46. (1.00 pts) What is the fold structure created when an anticline's limbs are further folded into anticlines themselves?

- [ ] A) Antiformal Anticline
- [ ] B) Synformal Anticline

- (●) C) Anticlinorium
- ( ) D) Synclinorium
- ( ) E) Plunging Anticline

47. (1.00 pts) Which group of clastic sedimentary rock is defined by >75% silt and clay?

- ( ) A) Breccia
- ( ) B) Sandstone
- ( ) C) Conglomerate
- (●) D) Mudstone
- ( ) E) Coal

48. (1.00 pts)
The grade of metamorphism changes as temperature and pressure changes. If a specific rock exists at 200°F and 800 MPa, what grade of metamorphism does it exist in?

- ( ) A) Contact
- ( ) B) Diagenesis
- ( ) C) High
- (●) D) Intermediate
- ( ) E) Low

49. (1.00 pts) If a certain fold has an interlimb angle of 28°, what category does the fold fall into in terms of its tightness?

- ( ) A) Gentle
- ( ) B) Open
- ( ) C) Closed
- (●) D) Tight
- ( ) E) Isoclinal

50. (1.00 pts) What are the topographical barriers that separate drainage basins?

Watersheds

Section 2: Free Response

The following questions are all free response. Make sure to answer every part of the question. Partial credit will be given.

Good Luck!

51. (1.00 pts) What is the shape of the Earth?

Expected Answer: Oblate Spheroid or Oblate Ellipsoid (either answer is acceptable)

52. (6.00 pts) Describe the three main mechanisms that drive plate tectonics.

Expected Answer: Slab pull (States that plate motion is caused by the pull of the plate as its subducting), Ridge push (proposed driving force for plate motion in plate tectonics that occurs at mid-ocean ridges as the result of the rigid lithosphere), Slab suction (occurs when the subducting slab pulls on the underlying mantle and sucks in the plates close to the subducting plate)

53. (2.00 pts) Describe what defines the Conrad and the Moho discontinuities.

Expected Answer: Conrad (Boundary where the seismic wave velocity increases in a discontinuous way, also marks the border between the upper crust and the lower crust going from sial to sima), Moho (Defined by a distinct change in the velocity of seismic waves as they pass through changing densities of rock)

54. (3.00 pts) Describe at least 3 different types of ripple sedimentary structures.

Expected Answer: Straight (Generate cross-laminae that all dip in the same direction, and lay in the same plane, constructed by unidirectional current flow), Sinuous (Generate cross-laminae that are curvy, formed by current that dips at an angle to the flow as well as downstream, also formed by the unidirectional current), Catenary (Generate cross-laminae that are curvy but have a unidirectional swoop, show a pattern similar to a repeated “W”, created by unidirectional flow with the dip at an angle to the flow as well as downstream), Linguoid (Generate an angle to the flow as well as downstream) (any three of these with their descriptions)

55. (4.00 pts) Name the four system tracts in the depositional system tract model.

Expected Answer: Falling-stage, Highstand, Transgressive, Lowstand

56. (4.00 pts) What are Type 1 and Type 2 depositional sequence boundaries?

Expected Answer: Type 1 (Characterized by subaerial exposure and concurrent subaerial erosion associated with stream rejuvenation, a basinward shift of facies, a downward shift in coastal onlap, and onlap of overlying strata), Type 2 (marked by subaerial exposure and a downward shift in coastal onlap landward of the depositional-shoreline break; however, it lacks both subaerial erosion associated with stream rejuvenation and a basinward shift in facies), Main distinction (amount of subaerial exposure) (anything close to that is fine)

57. (2.00 pts) In a geological cross section, how would someone differentiate a retrogradational parasequence?

Expected Answer: In a cross section, retrogradational parasequence recognized by the landward transition of the contact between deeper water facies and shallower water facies

58. (2.00 pts) In a geological cross section, how would someone differentiate a degradational parasequence?

Expected Answer: In a cross-section, recognized by the seaward and downward (down the depositional slope or dip) movement of a particular facies contact

59. (2.00 pts) What is the difference between azimuth bearings and quadrant bearings?

Expected Answer: Azimuth Bearings (Uses the full 360 degrees on a compass to indicate direction; the compass is numbered clockwise as 0 degrees is north, 90 degrees is east, and so on), while Quadrant Bearings (The compass is divided into 4 sections, each containing 90 degrees; use cardinal directions with degree measurements to show between each direction)

60. (2.00 pts) Describe the characteristics of a strombolian volcanic eruption.

Expected Answer: Relatively mild blasts; consist of ejection of incandescent cinder, lapili (tephra), and lava bombs; eruptions are small to medium, with sporadic violence; the lava flows are more viscous than the Hawaiian eruptions; this eruptive activity can last for a long time; these eruptions develop a lot of gas, which erupts the magma in the air (anything that includes things related to this is fine)

61. (2.00 pts) Describe the characteristics of a pelean volcanic eruption.

Expected Answer: Produce viscous magma, typically rhyolitic or andesite; share similarities with vulcanian eruptions; forms lava domes as well; creates pumice cones; initial phases of eruption include pyroclastic flow; these tephra deposits are smaller and have lower range than the other eruptions; the viscous lava can make a steep sided dome, which may collapse, leading to flows of ash (anything that includes things related to this is fine)

62. (2.00 pts) What is an ophiolite sequence? At what kind of plate boundary is this structure likely to be found?

Expected Answer: Section of the Earth's oceanic crust and the underlying upper mantle that has been uplifted and exposed above sea level and often emplaced onto continental crustal rocks; formed by convergent plate boundaries

63. (2.00 pts) What is a clinometer? What is it used for?

Expected Answer: An instrument for measuring the angle between an inclined surface and the horizontal datum. The clinometer is used to measure the dip of a bedding plane, a cleavage plane, a fault plane, etc., and the plunge of a lineation, a fold axis, a ripple crest, etc.

64. (4.00 pts) Describe how S-wave and P-wave velocities change when traveling through the Earth.

Expected Answer: Both P and S-Waves increase in velocity going down the mantle. As they reach the D" layer, the velocity of P-waves decrease considerably, and the velocity of S-waves decrease to 0. This velocity increases somewhat in the outer core for P-waves, but stays at 0 for S-waves. The velocity for S-waves are nonzero in the inner core. (anything that matches this somewhat is acceptable)

65. (2.00 pts) What is a Rayleigh wave? How is it created?

Expected Answer: Type of surface wave that travels near the surface of solids, include both longitudinal and transverse motions. Generated by the interaction of P and S waves at the surface of the Earth

66. (4.00 pts)
Let's say that for a given earthquake, it takes 7 minutes from the rupture of the fault for the P-waves to reach a certain seismometer. Using this information, approximately how far away is the epicenter of this earthquake?

Expected Answer: 4000 km (anything close to this is fine +/- 100 km)

67. (4.00 pts)
Let's say that for another unrelated earthquake, it takes 18 minutes and 40 seconds from the rupture of the fault for the S-waves to reach a certain seismometer. Using this information, approximately how far away is the epicenter of this earthquake?

Expected Answer: ~7000 km (anything close to this is fine +/- 100 km)

68. (6.00 pts) Describe at least three factors that affect deformation

Expected Answer: Temperature (At high temperature molecules and their bonds can stretch and move, thus materials will behave in a more ductile manner; at low temperatures, materials are brittle), Confining Pressure (At high confining pressure materials are less likely to fracture because the pressure of the surroundings tends to hinder the formation of fractures; at low confining stress, material will be brittle and tend to fracture sooner), Strain Rate (At high strain rates material tends to fracture; at low strain rates more time is available for individual atoms to move and therefore ductile behavior is favored), Mineral Composition (due to the chemical bond types that hold them together), Presence or Absence of Water (Water appears to weaken the chemical bonds and forms films around mineral grains along which slippage can take place) (accept any three of these alongside their descriptions)

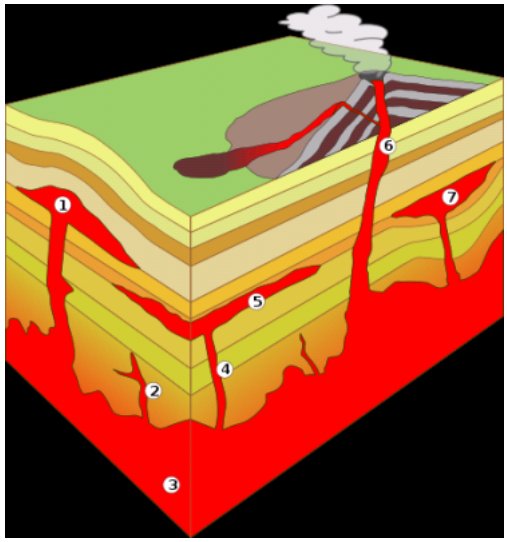
69. (3.00 pts) What are the three stages of deformation?

Expected Answer: Elastic Deformation (Wherein the strain is reversible), Ductile Deformation (Wherein the stress is irreversible), Fracture (when the material breaks)

70. (2.00 pts) What is the Alvarez hypothesis?

Expected Answer: Says that the mass extinction of the dinosaurs and many other living things during the C-PA extinction event was caused by the impact of a large asteroid on Earth; said that the asteroid caused the Chicxulub crater in Mexico; evidence for this theory includes the K-Pg boundary layer being more concentrated in iridium than the surrounding rock (anything related to this is acceptable)

71. (3.50 pts)



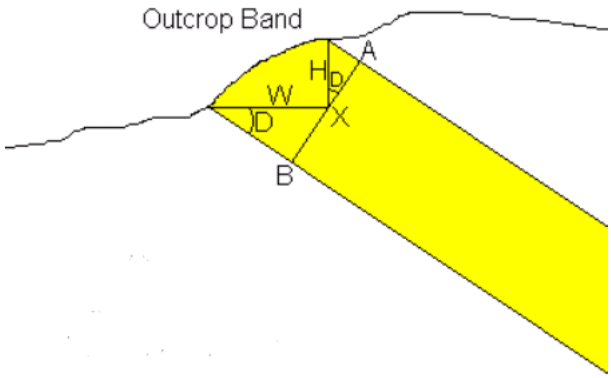
Look at the image above. Name the igneous intrusions 1-7.

Expected Answer: 1. Laccolith 2. Small Dike 3. Batholith 4. Dike 5. Sill. 6. Volcanic Neck, pipe 7. Lopolith

72. (2.00 pts) What is the relationship between the grain size of sediment found in a depositional sequence and the amount of energy in the system?

Expected Answer: As the amount of energy in the system increases, the grain size of the sediment in the depositional sequence also increases because they can carry larger grain sizes.

73. (3.00 pts)



What is the true thickness of the diagram above if D = 30° W = 2 and H = 5?

Expected Answer: 5.33 (+/- 0.1)

74. (3.00 pts) Given the true dip as 48° and the apparent dip as 67° what is the angle between the apparent and true dips?

Expected Answer: 61.87° (+/- 1°)

75. (3.00 pts) A bed outcrop has a width of 7.5m and a height of 2m. If the bed's dip angle is 70°, what is its true thickness?

Expected Answer: 7.73m (+/- 0.1m)

76. (1.50 pts) What is the length of the slope of a fault if the vertical throw of the fault is 70m, and the dip angle of the fault is 80°?

Expected Answer: 71.08m (+/- 0.1m)

77. (4.50 pts)
Let's say that you want to find the dip of a bed on a geologic map where the scale is 1 in = 100 m. You draw your strike lines at 650m and 750m on the contact lines of the bed such that they are 2.4 in apart. What is the dip angle of this particular bed according to the procedure shown?

Expected Answer: 22.62° (+/- 0.1°)

78. (4.00 pts) Briefly explain Walther's Law, and how it relates to vertical facies changes.

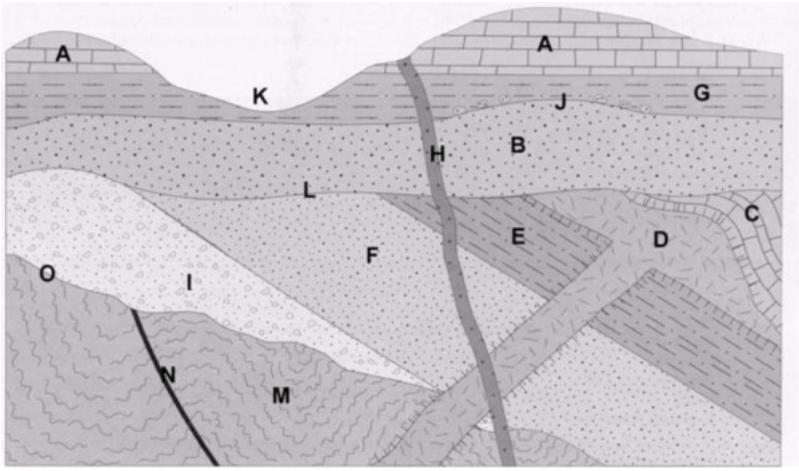
Expected Answer: Walther's Law states that facies which were once laterally adjacent will shift so that the deposits of one environment come to overlie those of an adjacent environment. This is because as laterally-adjacent sedimentary environments shift back and forth through time, as a result of sea level change, vertical facies boundaries also shift back and forth.

79. (3.00 pts)

Identify the depositional environment relating to the image above.

Expected Answer: Lacustrine

Section 3: Mapping



Use the image above to answer the following questions.

80. (15.00 pts) State these rock layers from oldest to youngest.

Expected Answer: M, N,O,I,F,E,D,C,L,B,J,G,A,H,K

81. (1.00 pts) What law/principle is rock layer H enacting?

- A) Law of superposition
- B) Law of original horizontality
- C) Cross Cutting relationships
- D) Principle of faunal succession

82. (1.00 pts) What is the more accurate name of the rock layer D?

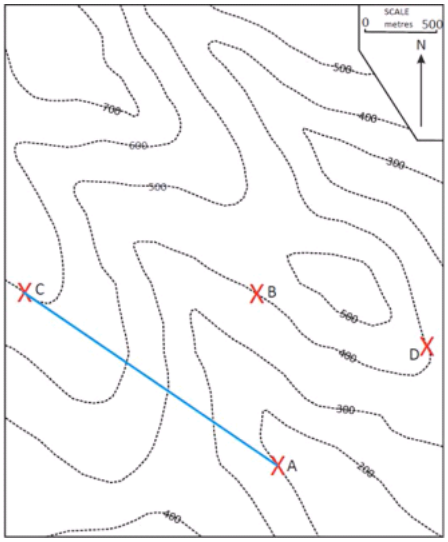
- A) Dike
- B) Laccolith
- C) Sill
- D) Batholith

83. (1.00 pts) Why is rock layer L just a line?

- A) It is a discontinuity
- B) It is a very thin layer
- C) It was the folds of the previous rock layers
- D) It is a igneous intrusion

84. (1.00 pts) What law/principle is the cause for both parts of rock Layer A to not have different letters?

- A) Law of superposition
- B) Law of original horizontality
- C) Law of lateral continuity
- D) Walther's law



Directions: Use the image above to solve the questions below. Use points A,B,C in your 3-point problem; disregard D.

Disregard the scale; the distance between points C and A is 2140m. Round to the nearest tenth. Assume this is an outcrop of a coal seam.

85. (9.00 pts) What is the apparent dip of a bed outcropping at points A, B, and C?

Expected Answer: 10.6° (+/- 0.1°)

86. (7.00 pts) What is the true dip of the bed outcropping at points A, B, and C if the length of the line that joins the line between A and C and the strike line is 780m?

Expected Answer: 14.4° (+/- 0.1°)

87. (1.50 pts) What is the contour interval?

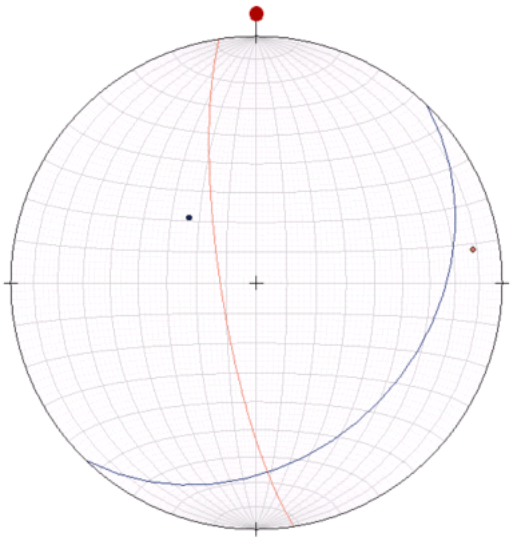
Expected Answer: 100

88. (1.50 pts) After drawing structure contours, what is the depth at which coal will be encountered at borehole D?

Expected Answer: 200

89. (5.00 pts)
Let's say a stream exists that goes through points A and B on the map. Toward which point would this stream be flowing, and if the distance between A and B is 4.34 in on the map, what is the stream gradient? Use the scale for this question (2.5 in = 500m).

Expected Answer: This stream would flow towards point A; 0.23 (+/- 0.1)



For the following questions use the image above. (Strike and Trend acceptable range within +/- 15, Dip and Plunge acceptable range within +/- 5)

90. (8.00 pts) What is the strike and dip of orange and blue planes?

Expected Answer: orange = strike - 171 dip - 78 blue = strike - 44 dip - 31

91. (8.00 pts) What is the trend and plunge of the orange and blue lines?

Expected Answer: Orange = trend - 81 plunge - 12 blue = trend - 314 plunge - 59

92. (4.00 pts) What is the trend and plunge of the intersection of the planes?

Expected Answer: Trend = 177 plunge = 24

93. (4.00 pts) What is the strike and dip of the plane defined by the given two lines?

Expected Answer: Strike = 267 dip = 66

94. (2.00 pts) What is the angle between the two given lines?

Expected Answer: Angle = 46

95. (1.50 pts) What is a great circle?

Expected Answer: Great circle is a plane that has its strike in the north of the stereonet

96. (1.50 pts) What is a pole of a plane?

Expected Answer: A pole is 90 degrees across the stereonet from the original dip

Congratulations on finishing! Don't forget to check your answers. Once you do, feel free to submit. Good luck on your other events!