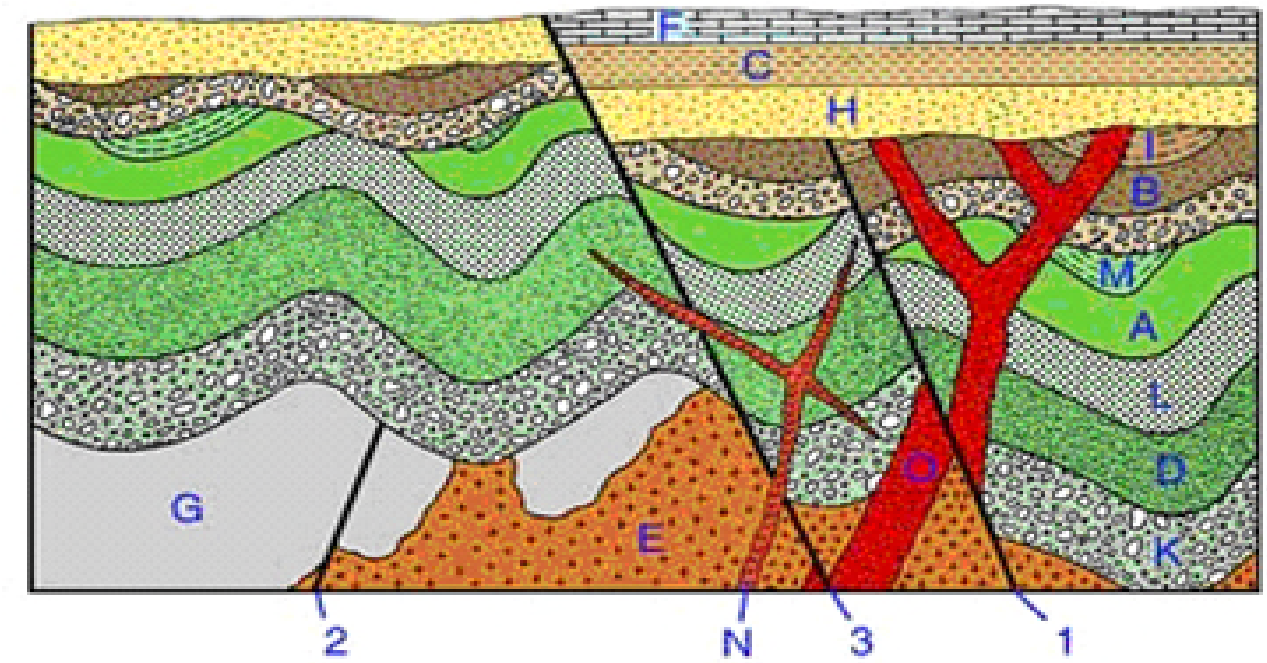
Name: **Class:** **Grade:**

GEOL101 Laboratory - Preparatory Lab for Final Exam

Introduction & Purpose: In this lab you will review and improve upon the geologic concepts and skills covered in the second final exam that you will be taking next week. This worksheet is designed to simulate the final exam material and format.

Part I. Relative Age - Geologic Block Diagram

Directions: Study the stratigraphic block diagram below. Use diagram below to answer questions 1 through 5.



1.The illustration above shows a geologic cross section. On a piece of paper, figure out the correct order, from oldest to youngest, in which the various rock units and faults were created. Choose the list from the selection below that has the correct temporal order of the seventeen lettered and numbered geologic features --- ordered from <u>OLDEST (left end) to YOUNGEST (right end)</u>

a.	E, G, 2, N, O, K, D, L, A , M, B, I, 1, H, C, F, 3
b.	E, G, K, 2, D, L. A, M, B, I , N, 1, O, 3, H, C, F
c.	F, C, H, O, 3, 1, N, B, I, M, A, L, D, 2, K, G, E
d.	G, E, 2, K, D, L, O, 1, H, C, A, M, B, I, F, 3, N
e.	G, E, 2, K, D, L, A, M, B, I, O, 1, H, C, F, 3, N
a. + b.	G, 2, E, K, D, L, 1, O, H, C, A, M, B, I, N. 3, F
b. + c.	B, I, O, 1, H, C, F, 3, N, G, E, 2, K, D, L, A, M
c. + d.	2, G, D, K, O, N, A, L, E, 3, F, C, H, 1, I, B, M
d. + e.	3, F, C, H, 1, I, B, M, A, L, D, K, O, N, 2, G, E

2. The key stratigraphic principle that you used to date geologic items K, D, L, A, M, B and I?

a.	Superposition
b.	Original horizontality
c.	Inclusion
d.	Cross-cutting

3.The key stratigraphic principle that you used to date geologic items 1, 2, 3, E, N, and O?

a.	Original horizontality
b.	Superposition
c.	Cross-cutting Inclusion
d.	Inclusion

4.The type of unconformity lying directly beneath layer H, in the region to the left of fault 3?

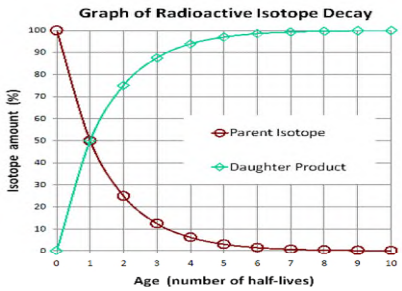
a.	Angular unconformity
b.	Disconformity
c.	Nonconformity
d.	Misconformity
e.	Geometric inconsistency

5.When did the folding event occur?

a.	After Formation H, but before Intrusion N
b.	After Fault 1, but before Intrusion O
c.	After Formation I, but before Formation H
d.	After Formation G, but before Formation I
e.	After Intrusion N, but before Fault 3

Part II. Stratigraphic Block Diagram Absolute Dating Determination

Directions: Calculate the correct absolute dates for the igneous rock units using the appropriate isotopic analyses and the radiometric dating method.



Isotopic Age Dating

Dating Method	Parent/Daughter Isotopes	Half Lives	Materials Dated	Age Date Range
Carbon (C)/Nitrogen (N)	C-14/N-14	5,730 years	Shells, limestone, organic materials	100-50,000 years
Potassium (K)/Argon (Ar)	K-40/Ar-40	1.3 billion years	Biotite, whole volcanic rock	100,000-4.5 billion years
Rubidium (Rb)/Strontium (Sr)	Rb-87/Sr-87	47 billion years	Micas	10 million-4.5 billion + years
Uranium (U)/Lead (Pb)	U-238/Pb-206	4.5 billion years	Zircon	10 million-4.5 billion + years
Uranium (U)/Lead (Pb)	U-235/Pb-207	710 million years	Zircon	10 million-4.5 billion + years

A. <u>Isotopic Analyses of Granite Pluton Unit "E"</u>: The granite intrusion "E" in the geologic block diagram contains pristine zircon crystals that were processed and analyzed for **Uranium-235 and Lead-207 content**. Laboratory analyses of the samples yielded the following U-235 / Pb-207 ratio:

Parent U-235 = 50% Daughter Pb-207 = 50%

6. Number of half lives elapsed: _____

a.	0.25
b.	0.5
c.	0.75
d.	1.0
e.	1.25

7. Calculated age of Granite Intrusion "E" = _____ million years old

a.	178
b.	355
c.	533
d.	710
e.	888

B. <u>Isotopic Analyses of Andesite Dike Unit "O"</u>: The andesite lava flow "O" in the geologic block diagram also contains pristine zircon crystals that were processed and analyzed for **Uranium-235 and Lead-207 content**. The laboratory analyses of the samples yielded the following U-235 / Pb-207 ratio:

Parent U-235 = 70.7% Daughter Pb-207 = 29.3%

8. Number of half lives elapsed: _____

a.	0.25
b.	0.5
c.	0.75
d.	1.0
e	1.25

9. Calculated age of Andesite Dike Unit "O": = _____ million years old

a.	178
b.	355
c.	533
d.	710
e.	888

C. <u>Fossil Analyses of</u> Neuropteris. Directions: Fern leave fossil imprints of ***Neuropteris*** were found in **Rock Unit "H".** Using your lab manual, determine the age range of this fossil.

10. The age range of Neuropteris is _____ **million years old**

a.	60 to 80
b.	150 to 170
c.	280 to 300
d.	430 to 450
e.	470 to 490

Absolute Age of granite = _____ m.y.o

Absolute Age of dike = _____ m.y.o

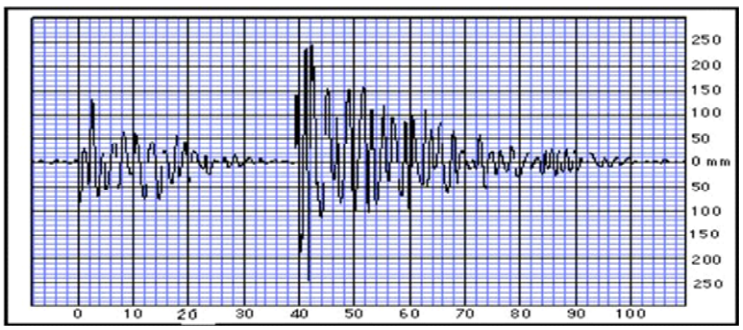
Age range of fern fossil = _____ to _____ m.y.o

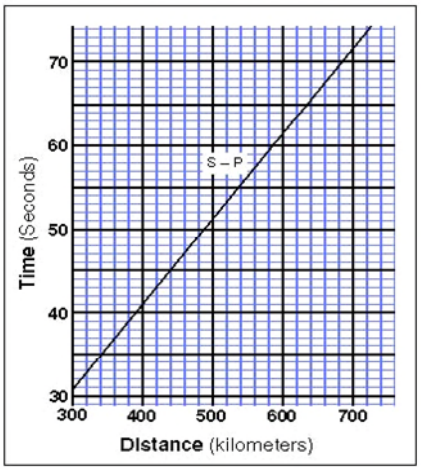
11. Based on above age data, the <u>*Best Constrained Age Range*</u> of the Unconformity that lies directly beneath layer "H" and above dike "O", is _____ to _____ millions of years

a.	150 to 170
b.	170 to 355
c.	280 to 355
d.	300 to 710
e.	355 to 710

Part III. Analysis of a Seismogram

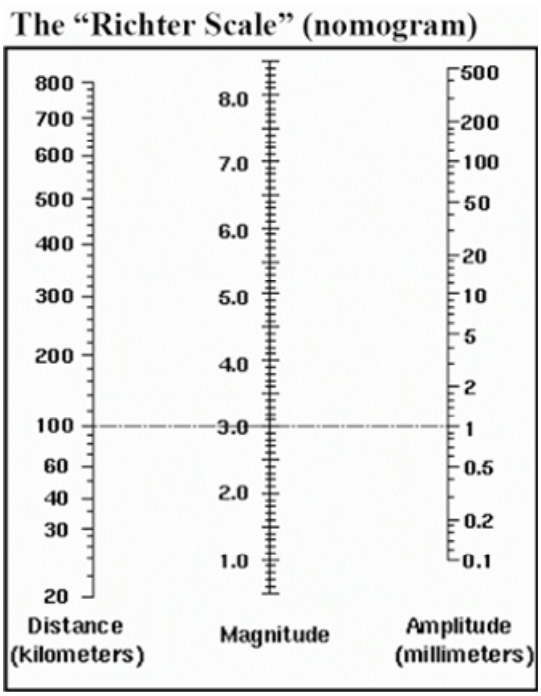
Directions: Study the seismogram from Phoenix, AZ, shown below. Use the S-P Interval chart to determine how far away Phoenix is to the earthquake epicenter. Then use Richter magnitude chart to determine the magnitude of the earthquake. **Note:** Ignore the seismogram above the Richter scale chart.





12. **How far away is Phoenix, Arizona from the earthquake epicenter?**

a.	Roughly 800 kilometers
b.	Roughly 600 kilometers
c.	Roughly 400 kilometers
d.	Roughly 200 kilometers



13. **What was the magnitude of the earthquake?**

a.	Greater than 6
b.	Between 5 and 6
c.	Between 4 and 5
d.	Between 3 and 4
e.	Less than 3

14. **Which of the following substrates poses the greatest seismic hazard for building a home on?**

a.	Granite
b.	Poorly-cemented sandstone
c.	Dry, compacted mix of sand and clay.
d.	Water-saturated, poorly compacted silt and sand

15. **Which of the following substrates poses the least seismic hazard for building a home atop?**

a.	Granite
b.	Poorly-cemented sandstone
c.	Dry, compacted mix of sand and clay.
d.	Water-saturated, poorly compacted silt and sand

PART IV - Ennis Quadrangle Topographic Map

Directions: Study the topo map provided to you by your instructor. Answer the following map questions.

16. Verbal map scale? 1 inch of map distance equals _____ mile(s) of real ground distance.

a. 10
b. 5
c. 1
d. 0.5

17. The contour interval is _____ feet.

a. 80
b. 60
c. 40
d. 20

18. The magnetic declination for the Ennis Montana region is _____ _____

a. 13 E
b. 13 1/2 W
c. 18 1/2 E
d. 18 ½ W

19. Which direction does the Madison River flow?

a. Northward
b. Southward
c. Impossible to tell.
d. Either northward or southward - depends on the time of year.

20. Which direction does the Cherry Creek flow?

a. West
b. East
c. Impossible to tell.
d. Either west or east - depends on the time of year.

21. What are the directions of latitude and longitude on this map?

a. North Latitude; South Longitude
b. West Latitude; East Longitude
c. North Latitude; West Longitude
d. South Latitude; East Longitude

22. What is the geographic location name listed on the map with the following UTM coordinates?
Northing: 5.016,500 m N, Easting 452,500 m E NOTE: This is **Location "A"** for later questions.

a. Town of Ennis
b. Fan Mountain
c. Jumping Horse Stock Ranch
d. Lake Ennis
e. Lawton Ranch

23. What are the latitude-longitude coordinates for Southeastern shoreline of Lake Ennis (location is marked with a "+"? Note: This is **Location** "**B**" for later questions.

a. Latitude = 111˚ 47' 45"N Longitude = 45˚ 20' 00"W
b. Latitude = 111˚ 37' 45"N Longitude = 45˚ 00' 00"W
c. Latitude = 45˚ 25' 30"N Longitude = 111˚ 40' 00"W
d. Latitude = 45˚ 48' 40"N Longitude = 111˚ 28' 10"W
e. Latitude = 45˚ 56' 45"N Longitude = 111˚ 10' 00"W

24. What is the distance from Location A (Question 21) **to Location B** (Question 22)**?**

a. 17 miles
b. 13 miles
c. 8 miles
d. 5 miles
e. 2 miles

25. What is the AZIMUTH bearing from Location A (Question 21) **to Location B** (Question 22)**?**

a. 340
b. 240
c. 190
d. 60
e. 10

26. Which of the following *quadrant* compass bearings is the most accurate for the direction starting from Location A (Question 21) **and heading to Location B** (Question 22)**?**

a. Bearing = S20W
b. Bearing = S60E
c. Bearing = N20W
d. Bearing = N60E

27. The slope gradient of the Cedar Creek Fan (mountain front to Bear Creek) is _____ feet/mile.

a. 1000
b. 500
c. 250
d. 100

28. What type of vegetation covers the mountains?

a. No vegetation
b. Scrub
c. Wooded
d. Orchard
e. Vineyard

PART V.– La Mesa Quadrangle Topographic Map

Directions: Study the topo map provided to you by your instructor. Answer the following map questions.

29. The verbal scale is 1 inch of map distance equals _____mile(s) of real ground distance".

- **a.** about 0.2
- **b.** about 0.4
- **c.** exactly 1.0
- **d.** about 1.6

30. The contour interval is _____ feet.

- **a.** 80
- **b.** 60
- **c.** 40
- **d.** 20

31. The magnetic declination for the La Mesa Quad map is _____ _____

- **a.** 13 E
- **b.** 13 W
- **c.** 18 ½ E
- **d.** 18 ½ W

32. What is the geographic location name listed on the map with the following UTM coordinates?
Northing: 3.630,500 m N, Easting 497,000 m E NOTE: This is **Location "A"** for later questions.

- **a.** Lake Murray dam
- **b.** SDSU campus
- **c.** Fortuna Mountain
- **d.** Qualcomm Stadium
- **e.** Cowles Mountain

33. What are the latitude-longitude coordinates for Fortuna Mountain? Note: this is Location "B".

- **a.** Latitude = 33˚ 47' 45"N Longitude = 116˚ 20' 00"W
- **b.** Latitude = 32˚ 25' 00"N Longitude = 117˚ 48' 30"W
- **c.** Latitude = 32˚ 43' 30"N Longitude = 117˚ 25' 00"W
- **d.** Latitude = 32˚ 51' 00"N Longitude = 117˚ 03' 30"W
- **e.** Latitude = 31˚ 37' 45"N Longitude = 118˚ 10' 00"W

34. What is the distance from Location A (Question 28) **to Location B** (Question 29)**?**

- **a.** 17 miles
- **b.** 13 miles
- **c.** 10 miles
- **d.** 6 miles
- **e.** 3 miles

35. What is the AZIMUTH bearing from Location A (Question 28) **to Location B** (Question 29)**?**

- **a.** 325
- **b.** 240
- **c.** 190
- **d.** 65
- **e.** 10

36. Which way does the San Diego flow across this region?

- **a.** Westward
- **b.** Eastward

37. Which of the following *quadrant* compass bearings is the most accurate for the direction starting from Location A (question 28) **and heading to Location B** (question 29)**?**

a.S35W; **b.**S65W; **c.**S35W; **d.** S65W; **e**.N35W;

a. + **b**.N65W; **b.** + **c**.N35E; **c.** + **d**. N65E

38. What is the slope gradient of the south-facing side of Cowles Mountain? Measure from the peak top to intersection of Navajo Road and Golfcrest Drive.

a. 3300 feet/mile
b. 2300 feet/mile
c. 1300 feet/mile
d. 300 feet/mile
e. 30 feet/mile

39.The highest elevation on this map is _____feet.

a. less than 1500
b. between 1500 and 2500
c. between 2500 and 3500
d. between 3500 and 4500
e. greater than 4500

40. What is the magnetic declination for the mapped region?

a. 13 ½ E
b. 13 ½ W
c. 13 ½ N
d. 13 ½ S
e. Not shown on this map.

41. What type of vegetation covers Cowles Mountain?

a. No vegetation
b. Scrub
c. Wooded
d. Orchard
e. Vineyard

42. What is the INDEX contour interval on this map?

a. 50
b. 100
c. 200
d. 300

43. What is the elevation of the picnic areas around Lake Murray?

a. 640 feet
b. 540 feet
c. 520 feet
d. 460 feet
e. 390 feet

Part VI. Determining Strike and Dip

Directions: Use the Compass and Inclinometer, provided by your instructor, to determine the strike and dip of an inclined boards setup in the classroom. **Note:** Use the boards labeled "**A**" and "B", for your measurement.

44. **What is the strike of the inclined board labeled "A"**?

a.	NE-SW - closer to N-S than E-W
b.	NE-SW - closer to W-E than N-S
c.	NW-SE - closer to N-S than E-W
d.	NW-SE - closer to W-E than N-S

45. **What is the dip of the inclined board labeled "A"**?

a.	Dipping at a high angle to the West
b.	Dipping at a low angle to the West
c.	Dipping at a high angle to the East
d.	Dipping at a low angle to the East

46. **What is the strike of the inclined board labeled "B"**?

a.	NE-SW - closer to N-S than E-W
b.	NE-SW - closer to W-E than N-S
c.	NW-SE - closer to N-S than E-W
d.	NW-SE - closer to W-E than N-S

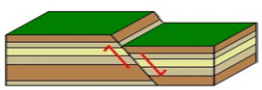
47. **What is the dip of the inclined board labeled "B"**?

a.	Dipping at a high angle to the West
b.	Dipping at a low angle to the West
c.	Dipping at a high angle to the East
d.	Dipping at a low angle to the East

Part VII. Fault ID

Directions: *Match the geologic feature (Capital Letter) with its associated geologic term (small-case letter(s)).* *Note:* For answers with two letters, bubble in two letters as a single answer.

a. Right-lateral strike-slip fault
b. Left-lateral strike-slip fault
c. Reverse fault
d. Normal fault
e. Oblique fault (combo dip-/strike-slip)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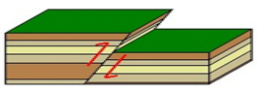
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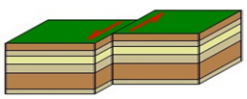
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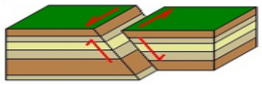
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_____ **48. Feature E**

____ **49. Feature F**

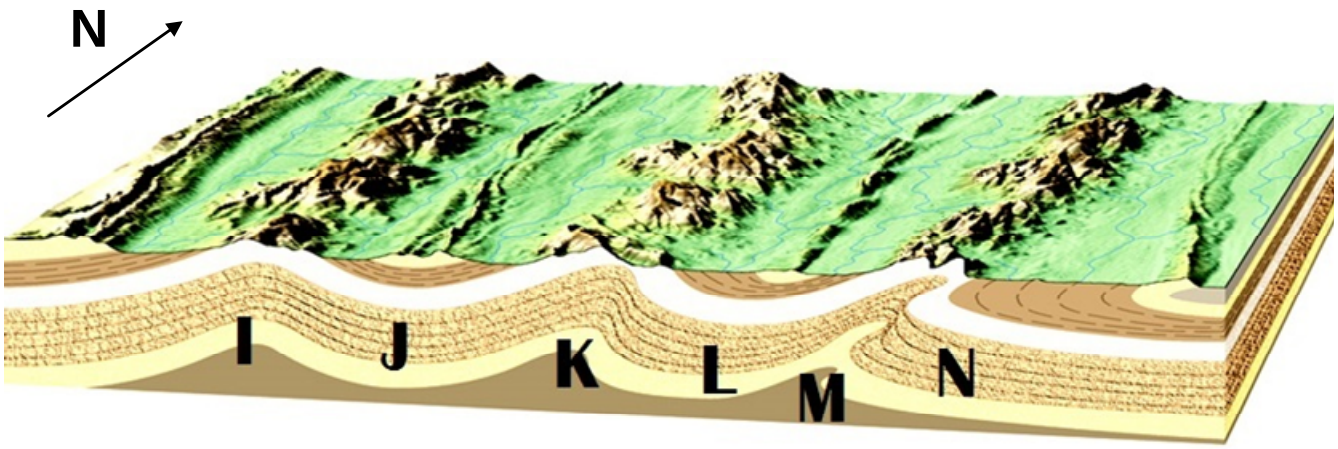
____ **50. Feature G**

____ **51. Feature H**

Part VIII. Fold ID

Directions: *Match the geologic feature (Capital Letter) with its associated geologic term (small-case letter(s)). Note:* For answers with two letters, bubble in two letters as a single answer.

a. Asymmetrical anticline
b. Asymmetrical syncline
c. Overturned anticline
d. Overturned syncline
e. Symmetrical anticline
a. + b. Symmetrical syncline



____ 52. Feature I
____ 53. Feature J
____ 54. Feature K
____ 55. Feature L
____ 56. Feature M
____ 57. Feature N

58. The set of folds above are plunging folds. True or false?

a. True
b. False

59. The fold axes for the set of folds in above diagram strike West-East. True or false.

a. True
b. False

Part IX. Munger Mountain Quadrangle Geology Map Analysis

Directions: Study the Munger Mountain Quadrangle geology map, including the cross-sections and map explanation. The following questions (51 to 66) pertain to the geology of this mapped region.Choose the answer that best completes the statement or answers the question.

60.The verbal scale is 1 inch of map equals _____mile(s) of real ground.

a. exactly two miles
b. exactly one mile
c. 0.4 mile
d. 0.2 mile

61. The contour interval is _____ feet.

a. 100
b. 80
c. 60
d. 40

62. Which direction does the Snake River flow?

a. North
b. South
c. Depends on what time of the year.

63. **What is the *youngest sedimentary* rock unit?**

- **a.** Twin Creek Limestone is youngest
- **b.** Frontier Formation is youngest
- **c.** Nugget Sandstone is youngest
- **d.** Mission Canyon Limestone is youngest

64. **What is the *oldest sedimentary* rock unit?**

- **a.** Twin Creek Limestone is oldest
- **b.** Frontier Formation is oldest
- **c.** Nugget Sandstone is oldest
- **d.** Mission Canyon Limestone is oldest

65. **What are the <u>two most common</u> rock types that are listed and described in the map *Explanation*?**

- **a.** Shale and siltstone
- **b.** Sandstone and conglomerate
- **c.** Limestone and sandstone
- **d.** Granite and gabbro

66. **During which Era did <u>most</u> of the rock formations form? Hint:** Match the periods to their respective era.

- **a.** Cenozoic
- **b.** Mesozoic
- **c.** Paleozoic
- **d.** Precambrian

67. What type of large-scale fold is found in the <u>eastern half</u> of the map? Note that this fold includes virtually all the rock formations listed on this map. But note: there are several smaller-scale folds within that fold. **Hint:** Make sure to look at the geologic cross section too. The instructor will point it out on the projector.

- **a.** Horizontal syncline
- **b.** Plunging syncline
- **c.** Horizontal anticline
- **d.** Plunging anticline

68. What is the general bearing of the strike of the fold axes (question 38)?

- **a.** East-West
- **b.** North-South
- **c.** Northeast-Southwest
- **d.** Northwest-Southeast

69. Which direction does the fold plunge (question 38)?

- **a.** Northeast
- **b.** Southeast
- **c.** Southwest
- **d.** Northwest

70. What were the directions from which crustal stress was applied to create this folded structure?

- **a.** East-West
- **b.** North-South
- **c.** Northeast-Southwest
- **d.** Northwest-Southeast

71. What type of fault is mapped 1 mile east of the Absaroka Thrust fault? Hint: Make sure to look at the geologic cross-section of this fault.

- **a.** Reverse fault
- **b.** Thrust fault
- **c.** Normal fault
- **d.** Left lateral strike-slip fault

72. Which direction is the Darby Thrust fault dipping? Hint: Check the geologic cross-section!!.

- **a.** The fault is dipping to the west
- **b.** The fault is dipping to the east
- **c.** The fault is a vertical-oriented fault

73. Which direction did the hanging wall moved on the Darby Thrust fault? Hint: Make sure to look at the geologic cross-section of this fault.

- **a.** Eastward and Up
- **b.** Eastward and Down
- **c.** Westward and Up
- **d.** Westward and Down
- **e.** There is no way to tell from the information on this map.

74. What's the likelihood that the three faults, noted above, were syn-tectonic with folding event? In other words, was it likely or unlikely that the three major faults on this map were active with the folding event in this region? Hint: Think about orientation of all features and their associated stress.

- **a.** Likely
- **b.** Unlikely

75. Which type of tectonic plate setting was most likely responsible for the various deformation event(s) mapped in this region?

- **a.** Divergent
- **b.** Convergent
- **c.** Transform
- **d.** Passive margin