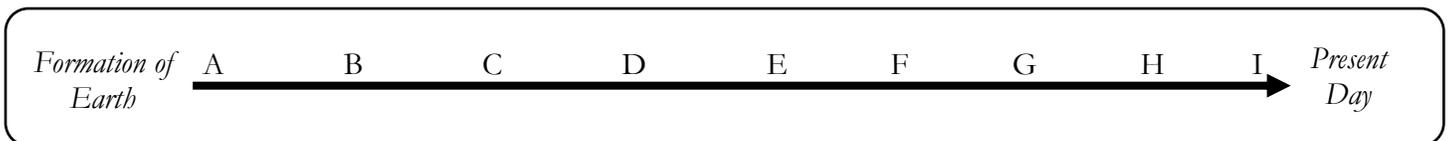


STATION ONE: IN THE NICK OF TIME

For questions 1-4, complete the geologic timeline with the missing time periods.

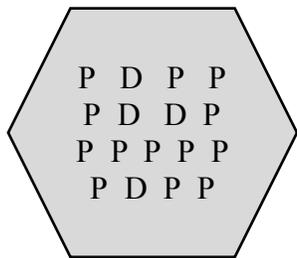
EON	ERA	PERIOD	
** Question 1 **	** Question 2 **	Quaternary	
		Neogene	
		Paleogene	
	Mesozoic		Cretaceous
			Jurassic
			Triassic
	Paleozoic		Permian
			Pennsylvanian
			Mississippian
			** Question 4 **
			Silurian
			Ordovician
			Cambrian
Proterozoic	Neoproterozoic		
	Mesoproterozoic		
	** Question 3 **		
Archean	Neoproterozoic		
	Mesoproterozoic		
	Paleoproterozoic		
	Eoarchean		
Hadean			

For question 5-6, consider the geologic timeline below.

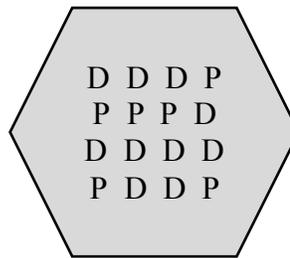


5. On the geologic timeline, what letter is closest to when Pangea broke up?
6. On the geologic timeline, what letter is closest to when the dinosaurs went extinct?

For questions 7-8, crystals 1 and 2 are zircons found in two different rocks. Each zircon crystal contains different amounts of a “parent element” (P) and a “daughter element” (D), where the daughter forms through the decay of the parent.



Crystal 1



Crystal 2

7. Crystal 1 is found in Rock 1, and Crystal 2 is found in Rock 2. Which rock is older?
8. For which of the following types of rock can this dating method not be used?
 - (A) Metamorphic rocks.
 - (B) Sedimentary rocks.
 - (C) Igneous rocks.
 - (D) It can be used to date all types of rocks.
 - (E) Dating is for significant others, not for rocks.

STATION TWO: ANYBODY HAVE A MAP?

For questions 1-4, consider Map A.

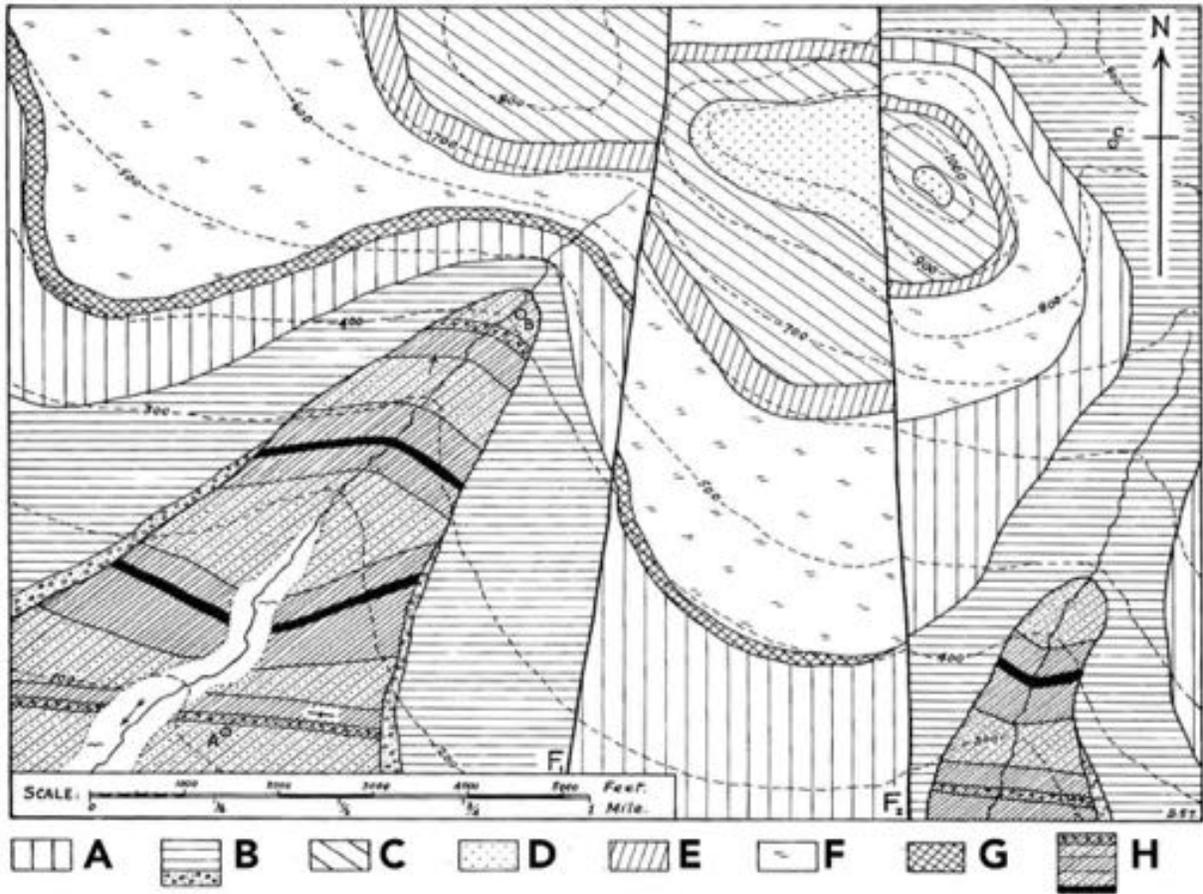
1. Give the letter of the oldest lithographic unit.
2. Which side of Fault 1 (F1)—the east side or the west side—was uplifted?
3. What type of fold is shown in the map?
4. Two faults (F1 and F2) are recorded in Map A. Which fault is older? (If there is not enough information to tell, circle “No” on your Answer Sheet.)

For questions 5-8, consider Map B.

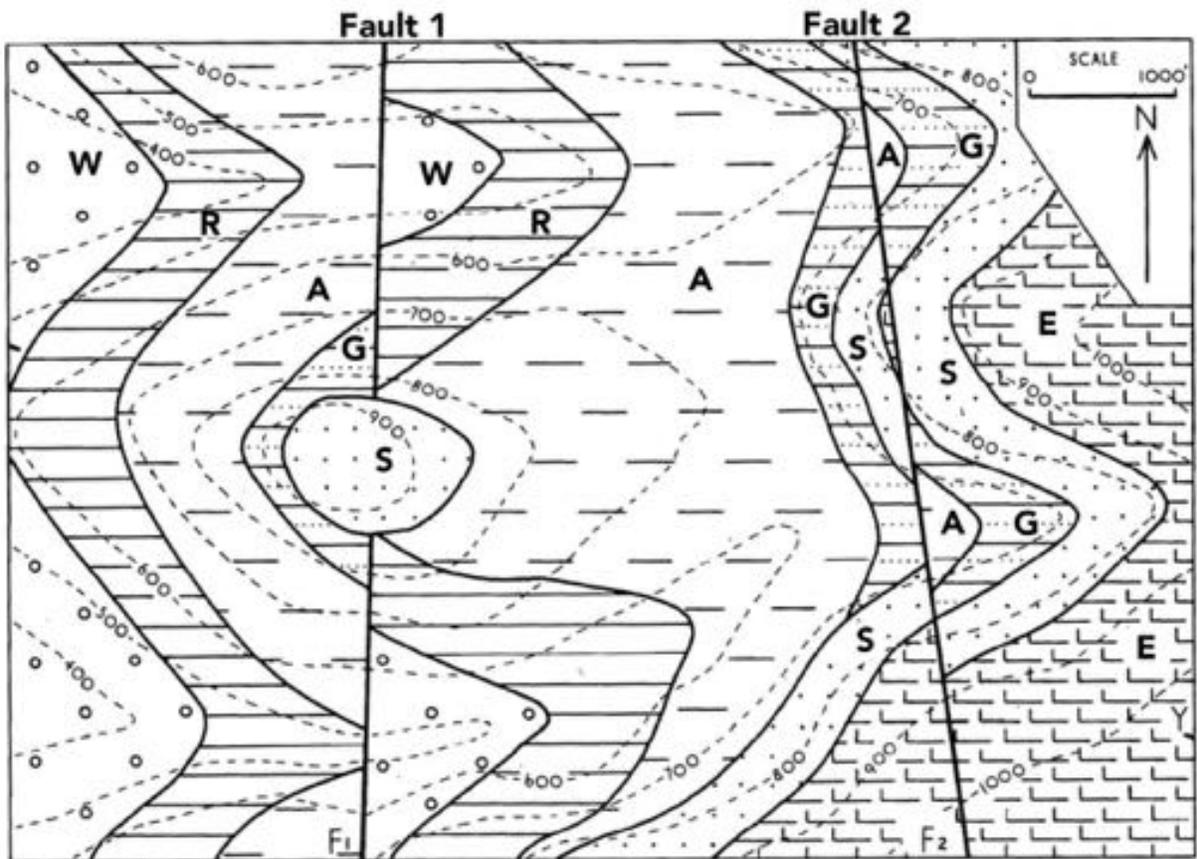
5. Give the letter of the youngest lithographic unit.
6. Give the letter of the oldest lithographic unit.
7. Which side of Fault 1 (F1)—the east side or the west side—was uplifted?
8. Two faults (F1 and F2) are recorded in Map B. Which fault is older? (If there is not enough information to tell, circle “No” on your Answer Sheet.)*

* It's not my *fault* if you get this wrong.

MAP A



MAP B



STATION THREE: A CUT ABOVE

For questions 1-2, determine if the statement is true or false. Circle the appropriate answer on your Answer Sheet.

1. Bedding in an outcrop is dipping 30°N , so it must have been originally deposited with a dip of 30°N .
2. Layers of rock are continuous until they either encounter something that stops their deposition or the depositional environment changes.

For questions 3-5, consider Cross Section A.

3. What rock formation was deposited immediately before “Blue Lias” (in box)?
4. What is the oldest lithological unit in Cross Section A?
5. What type of fold is present in Cross Section A?*

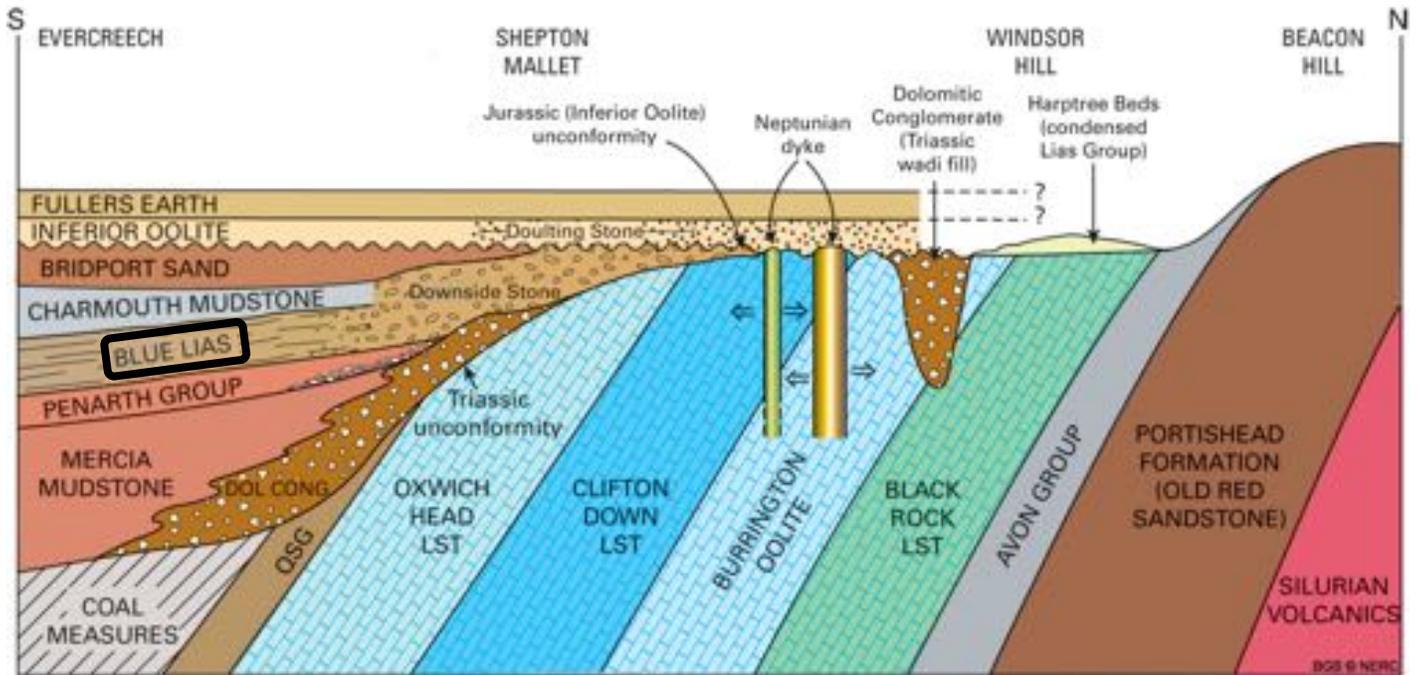
For questions 6-8, consider Cross Section B.

6. What is the oldest lithological unit in Cross Section B?
7. How many unconformities are in Cross Section B?
8. What type of fault is Fault K?

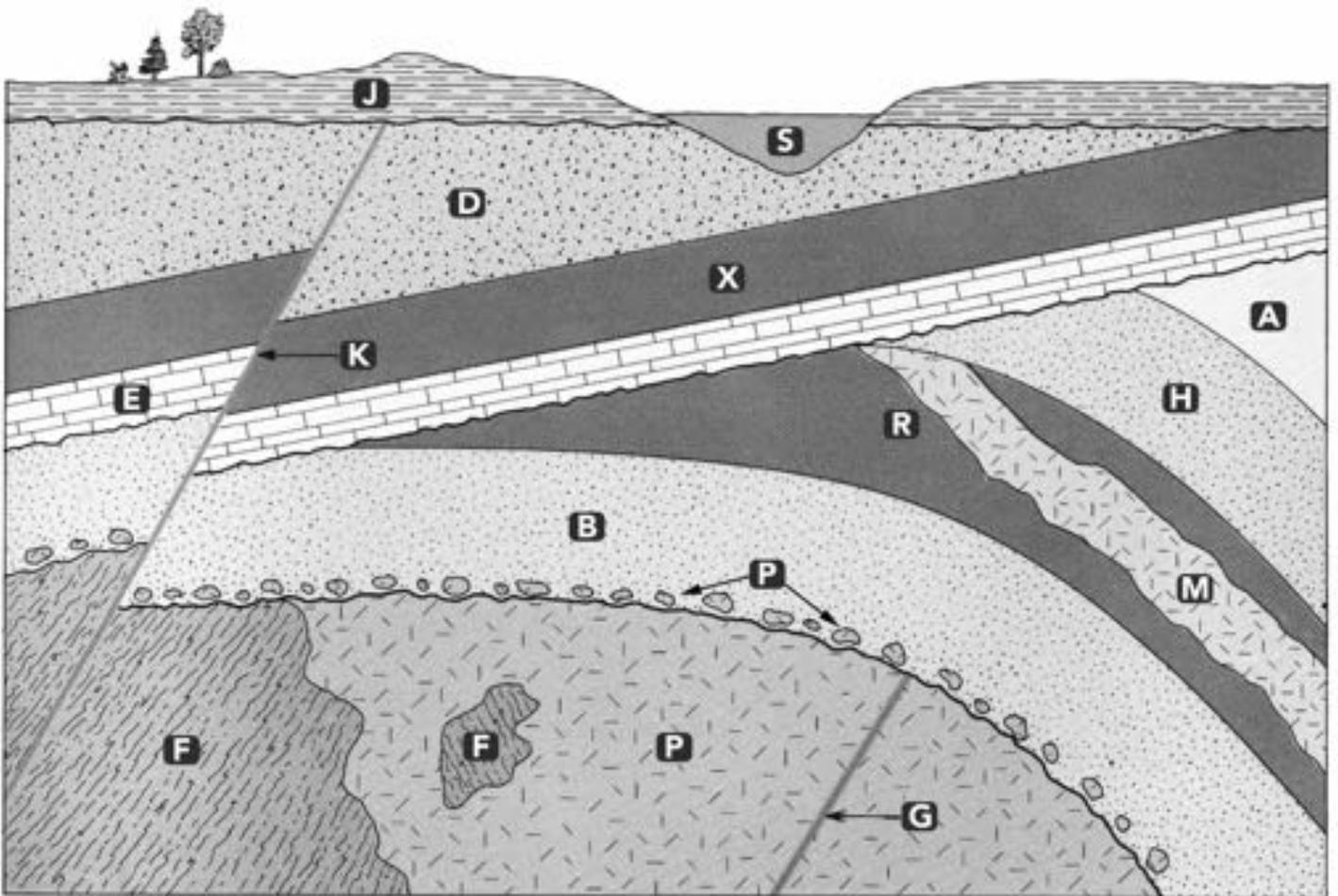
* And don't forget to *fold* your laundry, too!

CROSS SECTION A

British Geological Survey NERC, Shepton Mallet and Maesbury



CROSS SECTION B



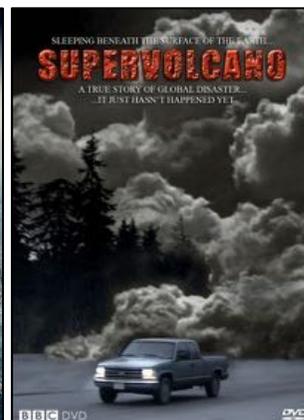
STATION FOUR: HISTORY HAS ITS EYES ON YOU

For questions 1-4, give the last name of the scientist described in the question on your Answer Sheet.

1. This seventeenth century scientist-turned-bishop discredited the idea that fossils “grew” from within the ground and proposed the seminal principles of stratigraphy, which still hold true today.
2. In 1915, this scientist proposed the theory of continental drift, which is the idea that continents “plow through” the ocean.
3. In 1953, this scientist—working with Bruce Heezen—created the first scientific map of the Atlantic Ocean floor.
4. In 1962, this scientist published “The History of Ocean Basins,” which outlined the idea of seafloor spreading as a mechanism for tectonic plate movement.

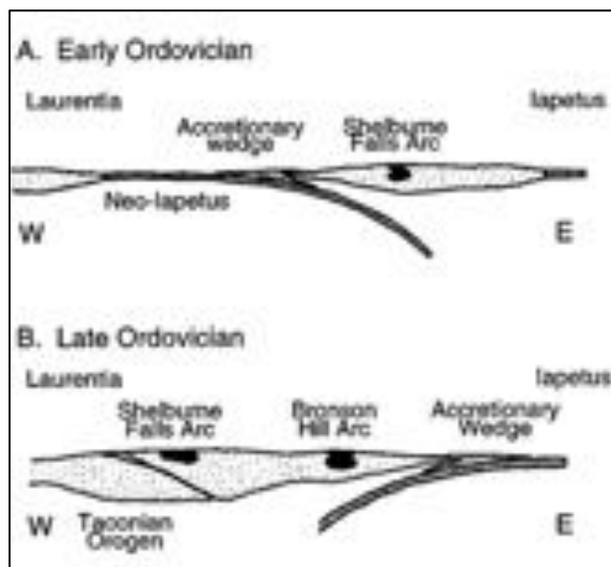
For each of the North American geologic events described in questions 5-7, give the name of the event on your Answer Sheet.

5. Scientists believe this mountain range formed because of a very low (shallow) angle at the subducting plate, which increased the friction between the oceanic and continental plates. Thus, tremendous thrusts built this mountain range very far inland.
6. When a passive margin turned into an active margin and the Iapetus oceanic plate began subducting under the North American craton, this mountain range formed along the continental margin.
7. Underneath a caldera sits this massive pool of partially melted granitic magma. Basaltic magma continues to rise underneath. Science fiction movies (e.g., see posters on right) enjoy postulating about what life would be like if this caldera erupted.*



For question 8, consider the diagram to the right,[†] which shows two phases of the Taconic Orogeny. Answer the question as concisely as possible.

8. What tectonic event/change shown in the diagram led to the formation of the Bronson Hill Arc?

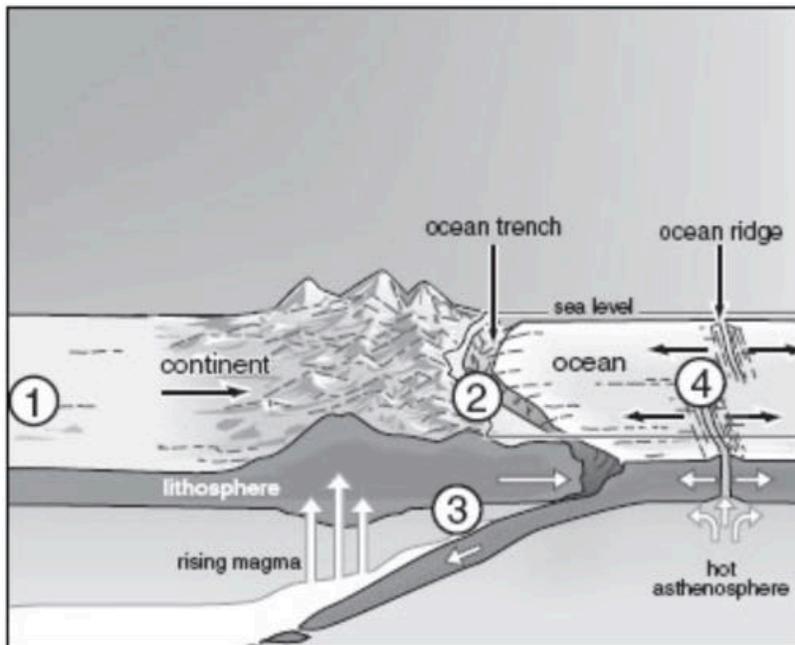


* “Yes, mom, watching these movies *is* studying for Dynamic Planet.”

† From Paul Karabinos, Williams College Geosciences.

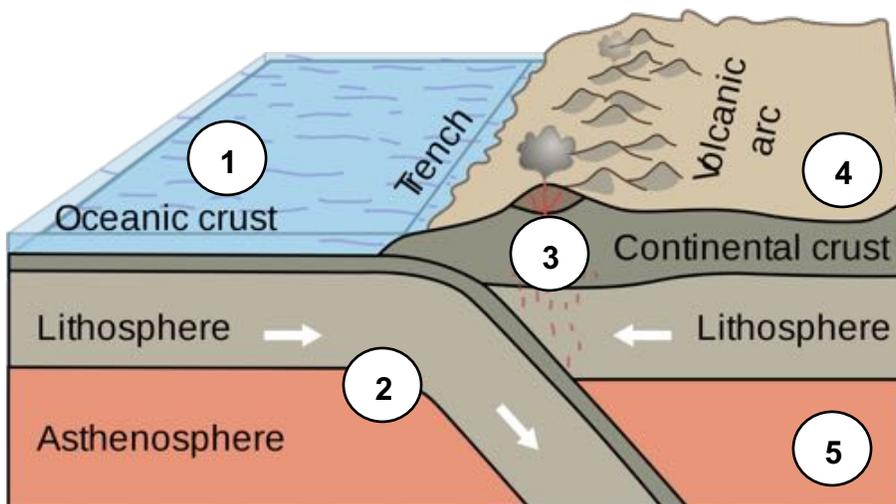
STATION FIVE: (M)ORE, PLEASE

For questions 1-2, consider the diagram below.



1. Give the number of the location where the most evolved magmas are produced.
2. Give the number of the location where the most primordial magmas are produced.

For questions 3-4, consider the diagram below.



3. Give the number of the location where ore could form.
4. Give the number of the location where hydrocarbons, such as oil and natural gas, would most likely form.

For questions 5-8, select the best response from the choices provided.

5. Felsic magmas have a ___ viscosity and a ___ crystallization temperature than mafic magmas.
(A) Lower ... Lower
(B) Higher ... Higher
(C) Lower ... Higher
(D) Higher ... Lower
(E) Same ... Same
6. Which of the following should be increased to melt a rock and create magma?
I. The temperature
II. The pressure
III. The water content
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III
(E) None of the above
7. Natural gas forms at ___ temperatures than oil, and natural gas is often made of ___ material.
(A) Higher ... Animal
(B) Higher ... Plant
(C) Lower ... Animal
(D) Lower ... Plant
(E) Equal ... Hershey's Kisses
8. Which of the following is the most common method of ore formation?
(A) Gases escape from volcanoes and precipitate an ore
(B) Liquid magma cools and solidifies, forming an ore
(C) Water is heated by magma, dissolves metals, and precipitates them
(D) Sedimentary sorting of minerals and metals in depositional environments
(E) All of the above are equally common.*

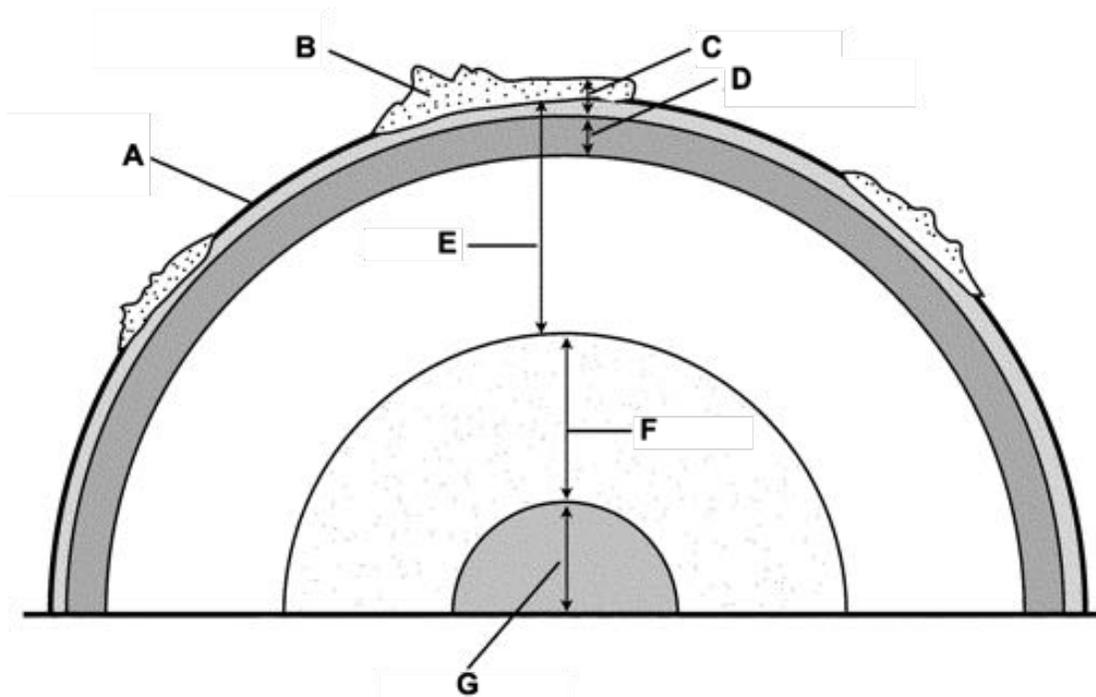
* Ore, maybe they're not? Ore, maybe I should stop making jokes in footnotes?

STATION SIX: LAYERS, LIKE ONIONS AND OGRES

Answer questions 1-2 as concisely as possible.

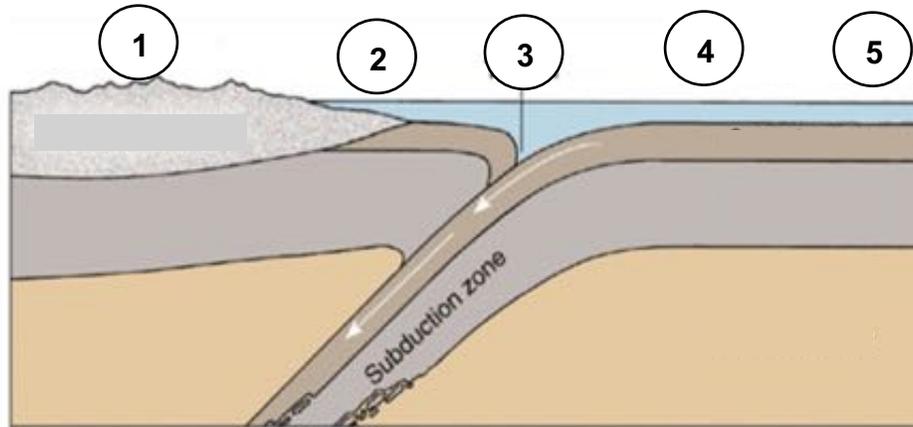
1. While global sea level is rising due to climate change, in some parts of Iceland, relative sea level is falling. Why?
2. Climate change, in many places, can lead to increases in precipitation. How does this affect mass wasting?

For questions 3-6, consider the diagram of the Earth's interior below.



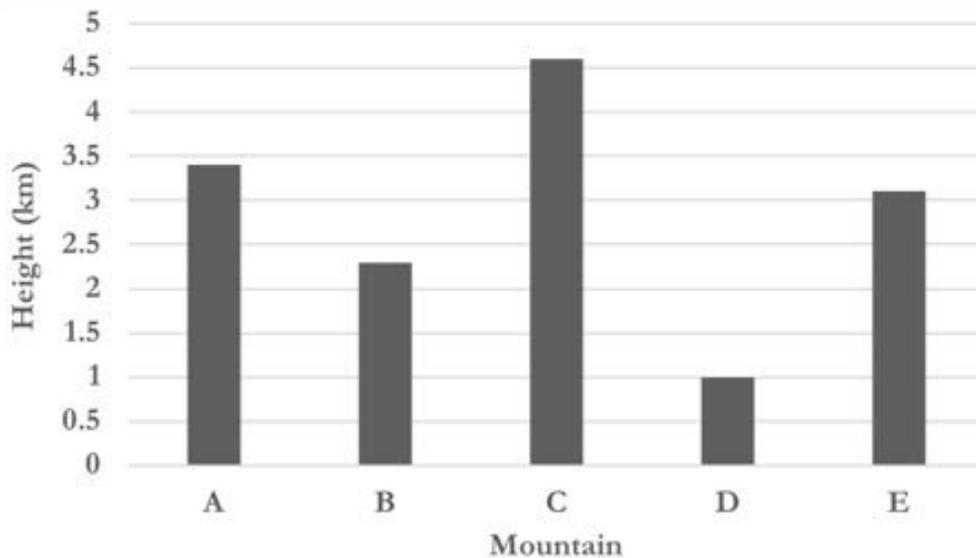
3. What letter represents the mantle?
4. What letter represents the asthenosphere?
5. What letter represents the Earth's layer that is composed of liquid iron and liquid nickel?
6. In the “rain-out” model of planetary formation:
 - (A) Layer E “rains out” of layers C and D.
 - (B) Layer E “rains out” of layers F and G.
 - (C) Layers F and G “rain out” of layer E.
 - (D) Layers C and D “rain out” of layer E. Layers F and G always exist.
 - (E) Layer G “rains out” of Layer F. Layer E always exists.

For question 7, consider the diagram below.



7. At what location would you expect to find a negative gravity anomaly? Give the number of the location.

For question 8, consider the graph below.

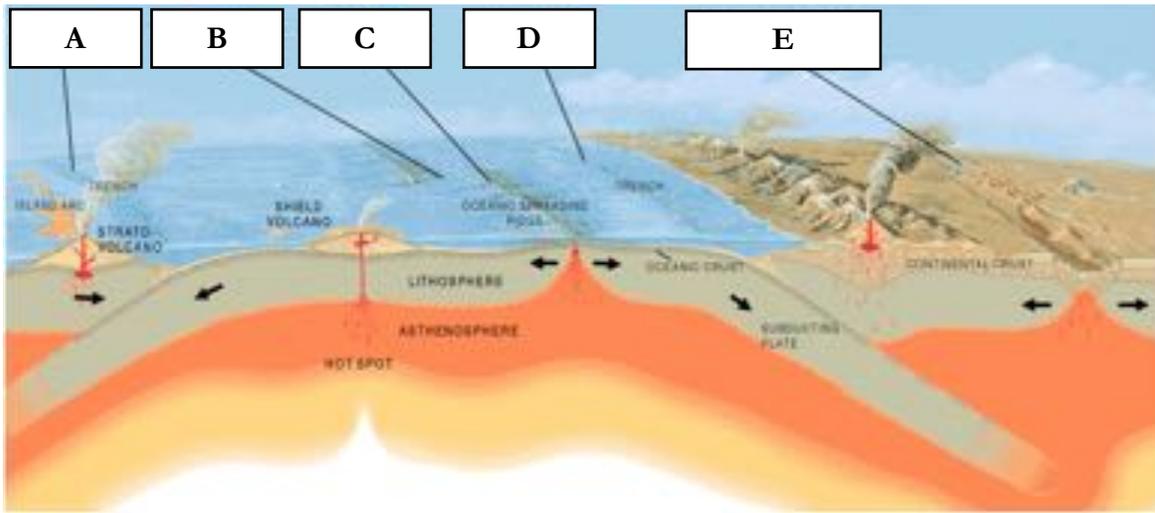


8. Which of the mountains would have the deepest roots? Which of the mountains would have the shallowest roots?*

* There ain't no mountain tall enough (or deep enough) to keep me from ... answering this question.

STATION SEVEN: CROSSING A (PLATE) BOUNDARY

For questions 1-2, refer to the cross section of the Earth below.



1. What type of plate boundary is at C?
2. 2a. What location has a plate boundary most similar to the one at A?
2b. What type of plate boundary is this?

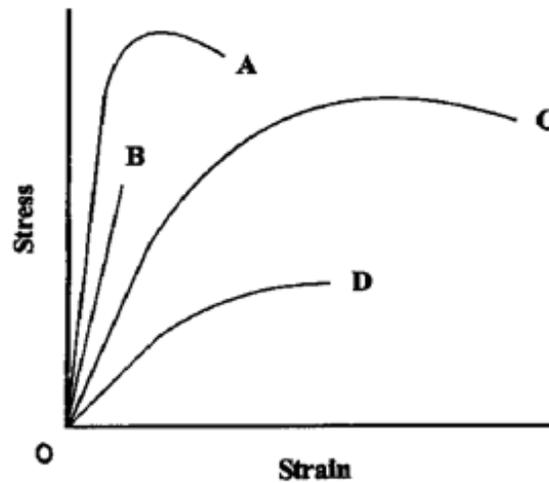
For questions 3-4, fill in the blank with "increase," "decrease," or "stay the same." Circle the correct answer on your Answer Sheet.

3. Through slab pull, the temperature of a plate will _____. The plate becomes more dense, sinking into the underlying mantle and pulling the rest of the plate with it.
4. Through ridge push, a plate's thickness will _____ as it moves away from the mid-ocean ridge, pushing it "downslope" to a subduction zone.

For questions 5, fill in the blank with the correct word.

5. When shear stress acts on a brittle rock, a _____ fault is formed.

For question 6, consider the graph below, showing the point at which four rocks shatter through changes in stress and strain.



6. Which rock – A, B, C, or D – is the strongest and stiffest?

For questions 7-8, consider the outcrop in the photograph below.



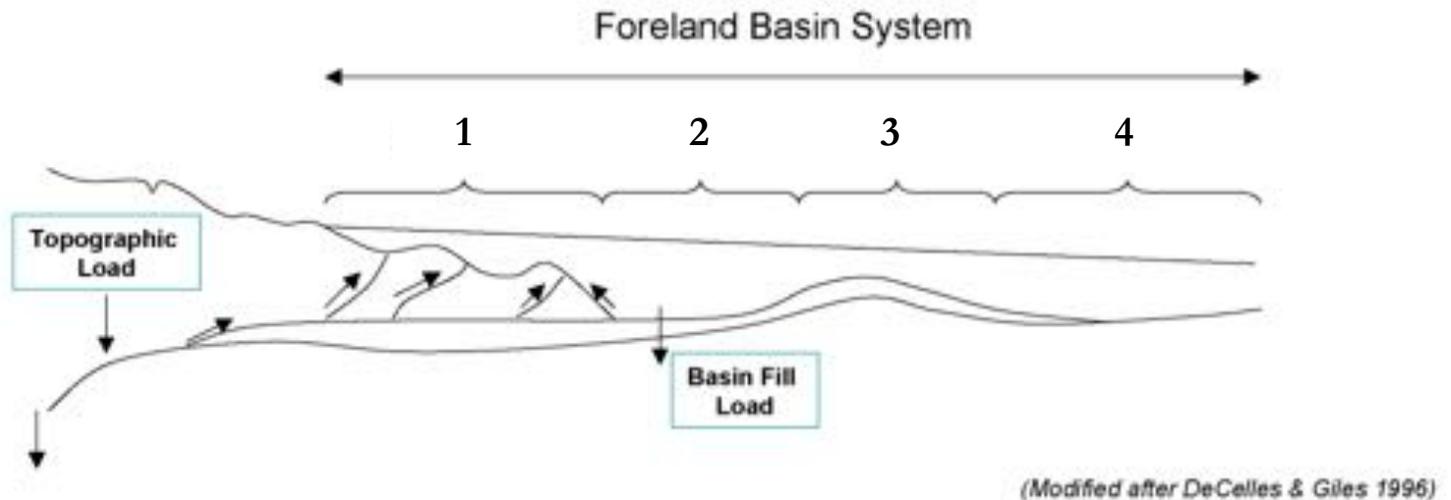
7. What type of stress acted on the outcrop above?*
8. A pebble in the rock formation above was originally 5 cm long. Then, due to the faulting shown, the pebble had a new length of 6 cm. Calculate the strain on the pebble.

* Hint: It's not the stress of taking this test.

STATION EIGHT: DROP THE BASIN

Station by Rishabh Gaur and William Baker, The Pembroke Hill School, Kansas City, MO

For questions 1-4, label the parts of the foreland basin shown below.



1. What is the name of Part #1 on the foreland basin?
2. What is the name of Part #2 on the foreland basin?
3. What is the name of Part #3 on the foreland basin?
4. What is the name of Part #4 on the foreland basin?

For questions 5-7, match the term with the correct definition from the choices below. Write the correct letter on your Answer Sheet.

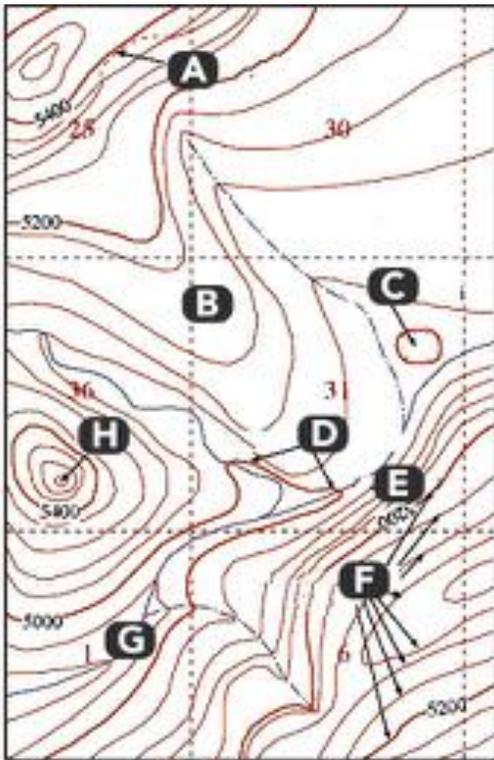
- A. On the leading edge of the continent where it is crashing into an oceanic plate
 - B. Lowland region formed by diverging plates
 - C. Sediment accreted from a sinking oceanic plate in a subduction zone
5. Trench
 6. Active margin
 7. Rift valley

For question 8, give the correct term for the definition below. Write the word/phrase on your Answer Sheet.

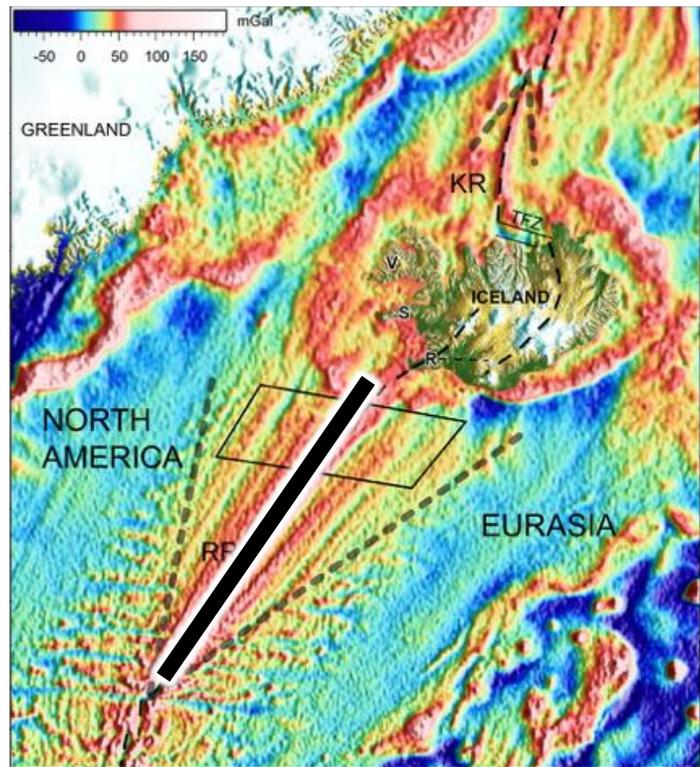
8. Technique developed to prevent or minimize damage to buildings during an earthquake where buildings are built separate from the shaking ground.

STATION NINE: ALL OVER THE MAP

MAP A



MAP B



For questions 1-2, consider the topographic map (Map A).

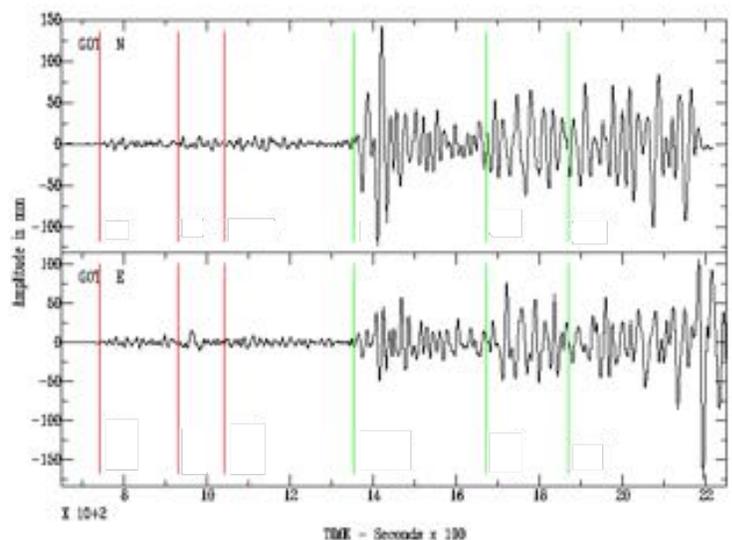
1. What letter on the map marks the highest point in the area?
2. What letter on the map marks the steepest slope in the area?*

For questions 3-4, consider the magnetic anomaly map of the North Atlantic (Map B).

3. What color on the map corresponds to the oldest oceanic crust?
 - (A) Red
 - (B) Yellow
 - (C) Orange
 - (D) Green
 - (E) Blue
4. What geologic/oceanic feature is marked by the thick black line south of Iceland?

For question 5, consider the seismograph data from the 1906 San Francisco earthquake shown to the right.

5. What time was the first P-wave recorded by the seismograph?



* Ideal spot for sledding.

For question 6, consider the outcrop below.



6. Are the rocks in this outcrop brittle or ductile?

For questions 7-8, consider the outcrop below from the Massachusetts-Vermont border.



A

B

7. In the outcrop above, what type of fold is A? What type of fold is B?
8. What is the geologic history of this outcrop? In other words, what caused these two folds to form? Give a short, one sentence explanation.

STATION TEN: **BACK TO THE DRAWING BOARD**

2 points per question

Draw the correct image in the box on your Answer Sheet.

- *For all the cross sections, north is into the page.*
- *Be sure to label your rock layers.*
 - *Use "A" for the oldest rock layer and progress up the alphabet (B, C, D, etc.) for younger rock layers.*

For questions 1-2, draw a map view (bird's eye view) of the feature described.

1. There is an anticline with a vertical axial plane and a fold axis that plunges 45° S.
2. There is a normal fault with a strike of 90° (E) and a dip of 75° N that cuts through horizontal bedding.

For questions 3-4, draw a cross section (road cut view) of the feature described.

3. There is a syncline that has a horizontal fold axis pointing into the page.
4. There is a full-graben cutting through horizontal bedding.*

* I'm graben a drink of water before the next station.