Base your answers to questions 1 and 2 on the world map below. Points A through H represent locations on Earth's surface.

1. Identify the tectonic feature responsible for the formation of the Hawaiian Islands.

2. Identify the two lettered locations from the map that are least likely to experience volcanic activity or earthquakes.

Base your answers to questions 3 through 5 on the block diagrams below, which show three types of streams with equal volumes.

3. Explain how the cobbles and pebbles that were transported by these streams became smooth and rounded in shape.

4. Explain why the outside of the curve of a meandering channel experiences more erosion than the inside of the curve.
5. Explain how the differences between the type 1 and type 3 stream channels indicate that the average velocities of the streams are different.

Base your answers to questions 6 through 10 on the topographic map shown below. Letters A, B, C, and D represent locations on Earth’s surface. The symbol ( marks the highest elevation on Patty Hill. Elevations are shown in feet.

6. On the grid below, construct a profile of the land surface along line CD. Plot the elevation of each contour line that crosses line CD. Connect the plots with a line to complete the profile.

7. A student placed a floating wooden block in Blue Creek at location A. Fifteen minutes later, the floating block arrived at location B. What was the creek’s rate of flow from A to B? Express your answer to the nearest tenth.

8. Explain how the shape of the contour lines crossing Blue Creek shows the direction that the creek is flowing.

9. Indicate, using a compass direction, the steepest side of Patty Hill.
10. What is a possible elevation at the symbol △ at the top of Patty Hill?

Base your answers to questions 11 through 14 on the topographic map shown below. Letters A, B, C, D, and E represent locations on Earth's surface. Letters K, L, M, and N are locations along Copper Creek. Elevations are measured in meters.

11. Explain how the map indicates that Copper Creek flows faster between points N and M than between points L and K.
12. On the grid below, construct a topographic profile along line $DE$ by plotting an X for the elevation of each contour line that crosses line $DE$. Connect the Xs with a smooth, curved line to complete the profile.

13. Calculate the gradient between points $B$ and $C$ and label your answer with the correct units.

14. What is the elevation of location $A$?

15. If the igneous rock is a layer of vesicular andesite, identify three types of mineral grains that could be found in the sand.

16. Describe the change in temperature and moisture conditions that would cause an increase in the rate of chemical weathering into clay.
17. Base your answer to the following question on the diagram and the stream data table below.

The diagram represents a stream flowing into a lake. Arrows show the direction of flow. Point $P$ is a location in the stream. Line $XY$ is a reference line across the stream. Points $X$ and $Y$ are locations on the banks. The data table gives the depth of water in the stream along line $XY$.

![Stream Diagram]

<table>
<thead>
<tr>
<th>Location $X$</th>
<th>Location $Y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from $X$ (meters)</td>
<td>0</td>
</tr>
<tr>
<td>Depth of Water (meters)</td>
<td>0</td>
</tr>
</tbody>
</table>

State why the depth of water near the bank at point $X$ is different from the depth of water near the bank at point $Y$.

18. Base your answer to the following question on the cross section below illustrates the normal pattern of sediments deposited where a stream enters a lake. Letter $X$ represents a particular type of sediment.

![Cross Section Diagram]

$\text{a}$ Briefly explain why deposition of sediment usually occurs where a stream enters a lake.

$\text{b}$ Name the type of sediment most likely represented by letter $X$. 

$\text {Not drawn to scale} $
19. Describe the texture shown by this metamorphic rock that indicates it could be schist.

20. Based on the minerals present, identify the relative color and density of this igneous rock compared to mafic igneous rocks with the same crystal size.

21. Identify the environment of formation of this igneous rock based on the size of its intergrown crystals.
Base your answers to questions 22 through 24 on the block diagram below, which shows rock units that have not been overturned. Point $A$ is located in the zone of contact metamorphism. A New York State index fossil is shown in one of the rock units.

22. Describe one piece of evidence that would indicate that the valley shown on the surface of the block diagram had been eroded and deepened by a glacier.

23. Identify the metamorphic rock that most likely formed at point $A$.

24. Identify the crystal size of the minerals in rhyolite and explain what this size indicates about the rate of cooling of the magma from which it formed.

Crystal size: ________________________________

Explanation: ________________________________

Base your answers to questions 25 through 27 on the diagram below, which shows a seismograph that recorded seismic waves from an earthquake located 4000 kilometers from this seismic station.

25. State one possible cause of the earthquake that resulted in the movement of the bedrock detected by this seismograph.
26. Which type of seismic wave was recorded first on the rotating drum?

27. How long does the first S-wave take to travel from the earthquake epicenter to this seismograph?

28. Base your answer to the following question on the cross section below. Letters A through H represent rock units in which overturning has not occurred.

Identify one metamorphic rock that could have formed at the boundary between rock unit E and rock unit H.
Base your answers to questions 29 and 30 on the map below. The map shows the approximate area in a portion of North America where some sedimentary rock layers composed of gypsum, halite, and potassium salt minerals are found in Earth’s crust.

### Mineral Deposits

#### Key

<table>
<thead>
<tr>
<th>Sedimentary Rock</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gypsum</td>
<td>□</td>
</tr>
<tr>
<td>Gypsum and halite</td>
<td>□□</td>
</tr>
<tr>
<td>Gypsum, halite, and potassium salts</td>
<td>□□□</td>
</tr>
</tbody>
</table>

29. Identify the sedimentary rock composed of halite and explain how this rock is usually formed.

30. Identify one New York State landscape region in which deposits of gypsum and halite are commonly found.
31. State one igneous rock that could be placed in the flowchart at D.

32. Contrast the rate of cooling at A that forms intrusive igneous rock with a rate of cooling at B that forms extrusive igneous rock.

33. Give the numerical grain-size range that should be placed in the flowchart at C. Units must be included in your answer.
Base your answers to questions 34 through 38 on the passage and map below. The map shows the volcanic island, Krakatau, before and after the 1883 eruption.

Krakatau

On August 27, 1883, one of the largest volcanic eruptions ever recorded in history occurred. Krakatau, a volcanic island nearly 800 meters in height, located at 6° S 105.5° E, exploded. Two-thirds of the island was destroyed by the blast. Blocks of pumice produced by the eruption were found floating in the ocean for months afterward. Tsunamis produced by the eruption reached heights of 40 meters as they came ashore on nearby islands. These destructive waves traveled 6360 kilometers in just 12 hours. Over 36,000 people died and 165 coastal villages were destroyed. Volcanic ash was blasted into the atmosphere to heights between 36 and 48 kilometers. Global temperatures cooled as the ash traveled on air currents around the world.

34. Describe the texture and density of pumice that allowed the blocks of pumice to float on the ocean.
   Texture: ___________________
   Density: ___________________

35. Explain how the volcanic ash from the Krakatau eruption caused global temperatures to decrease.

36. Identify the layer of the atmosphere into which the highest volcanic ash was blasted from the Krakatau eruption.

37. Determine the rate the tsunamis traveled across the ocean. Label your answer with the correct units.
   Rate = ________________
38. The diagram shows where Krakatau formed, then exploded. Draw one arrow on each lithospheric plate to show the relative direction that both plates are moving to produce this type of volcano.

Base your answers to questions 39 through 42 on the map below which shows the location of the epicenter of an earthquake that occurred on April 20, 2002, about 29 kilometers southwest of Plattsburgh, New York.

39. State the latitude and longitude of this earthquake epicenter. Express your answers to the nearest tenth of a degree and include the compass directions.

40. What is the minimum number of seismographic stations needed to locate the epicenter of an earthquake?
41. Explain why this earthquake was most likely felt with greater intensity by people in Peru, New York, than by people in Lake Placid, New York.

42. A seismic station located 1,800 kilometers from the epicenter recorded the $P$-wave and $S$-wave arrival times for this earthquake. What was the difference in the arrival time of the first $P$-wave and the first $S$-wave?