1. Which statement best supports the theory that all the continents were once a single landmass?
   (1) Rocks of the ocean ridges are older than those of the adjacent sea floor.
   (2) Rock and fossil correlation can be made where the continents appear to fit together.
   (3) Marine fossils can be found at high elevations above sea level on all continents.
   (4) Great thicknesses of shallow-water sediments are found at interior locations on some continents.

2. The epicenter of an earthquake is located 2,800 kilometers from a seismic station. Approximately how long did the $S$-wave take to travel from the epicenter to the station?
   (1) 11 min 15 sec  (3) 5 min 20 sec
   (2) 9 min 35 sec  (4) 4 min 20 sec

3. The diagram at the right represents a cylinder which contains four different liquids, $W$, $X$, $Y$, and $Z$, each with a different density ($D$) as indicated. A piece of solid quartz having a density of 2.7 g/cm$^3$ is placed on the surface of liquid $W$. When the quartz is released, it will pass through
   (1) $W$, but not $X$, $Y$, or $Z$
   (2) $W$ and $X$, but not $Y$ or $Z$
   (3) $W$, $X$, and $Y$, but not $Z$
   (4) $W$, $X$, $Y$, and $Z$

4. As surface runoff in a region increases, stream discharge in that region will usually
   (1) decrease  (3) remain the same
   (2) increase

5. The elevation of a certain area was measured for many years, and the results are recorded in the data table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>102.00</td>
</tr>
<tr>
<td>1890</td>
<td>102.25</td>
</tr>
<tr>
<td>1910</td>
<td>102.50</td>
</tr>
<tr>
<td>1930</td>
<td>102.75</td>
</tr>
<tr>
<td>1950</td>
<td>103.00</td>
</tr>
</tbody>
</table>

If the elevation continued to increase at the same rate, what was most likely the elevation of this area in 1990?
   (1) 103.25 m  (3) 103.75 m
   (2) 103.50 m  (4) 104.00 m

6. A contour map is shown below. Elevations are shown in feet.

Which side of Amethyst Hill has the steepest slope?
   (1) north  (3) east
   (2) south  (4) west
7. On each topographic map below, the straight-line distance from point A to point B is 5 kilometers. Which topographic map shows the steepest gradient between A and B?

(1) 

(2) 

(3) 

(4) 

8. In the diagram below, sample X and sample Y represent equal masses of earth material which are weathering under the same conditions. The samples have the same mineral composition.

The weathering rate for sample Y will most likely be

(1) less than X  (3) the same as X
(2) greater than X
9. Base your answer to the following question on the topographic map below. Elevations are in feet. Point A and B are locations on the map.

What is the gradient along the straight line between points A and B?
(1) 10 ft/mi  (2) 20 ft/mi  (3) 25 ft/mi  (4) 35 ft/mi

10. In what way is a pebble probably changing as it is carried by a mountain stream?
(1) Its density is decreasing.
(2) Its mass is decreasing.
(3) Its particle size is increasing.
(4) Its hardness is increasing.

11. The Appalachian Uplands region of New York State is classified as which type of landscape?
(1) plateau  (3) lowland
(2) highland  (4) coastal plain
12. Base your answer to the following question on the diagrams below, which show two soil cross sections from adjacent fields in New York State. Both soils are the same except that human activities have removed the vegetation from the surface of field B. Each field has been receiving rain for several hours.

Which change would most likely result from replanting vegetation in field B?
(1) Transpiration would decrease.
(2) Runoff would increase.
(3) Erosion would increase.
(4) Water infiltration would increase.

13. The photograph below shows actual crystal sizes in a light-colored igneous rock that contains several minerals, including potassium feldspar, quartz, and biotite mica.

The rock should be identified as
(1) granite    (3) basalt
(2) gabbro     (4) rhyolite

14. Base your answer to the following question on the diagrams below, which represent 500-milliliter containers that are open at the top and the bottom and filled with well-sorted, loosely packed particles of uniform size. A piece of screening placed at the bottom of each container prevents the particles from falling out.

Which graph best represents the rate of permeability of the samples?
(1)  
(2)  
(3)  
(4)  

15. Which evidence best indicates that a landscape has been eroded primarily by streams?
(1) parallel sets of U-shaped valleys
(2) sand dunes
(3) thick residual soil
(4) sorted layers of cobbles and sand

16. The Mohawk River and the Hudson River both flow primarily over a landscape region classified as
(1) lowlands    (3) highlands
(2) mountains   (4) plateaus
17. The diagram below shows a hand-sized rock sample with parallel sets of grooves. This rock sample was found in a gravel bank in central New York State.

The grooves were most likely caused by
(1) stream erosion  (3) alandslide
(2) wind erosion   (4) glacial erosion

18. The diagrams below represent two containers, each filled with a sample of nonporous particles of uniform size.

Compared to the sample of larger particles, the sample of smaller particles has
(1) lower permeability
(2) higher permeability
(3) less porosity
(4) more porosity

19. A sedimentary particle is dropped into a cylinder of water. The particle will take the longest time to settle if the particle has
(1) low density, small size, and spherical shape
(2) low density, small size, and flattened shape
(3) high density, large size, and spherical shape
(4) high density, large size, and flattened shape
20. Base your answer to the following question on the map below. Arrows on the map show the location and orientation of glacial striations on the surface bedrock. Dark shading shows the location of large moraines (glacial deposits).

The striations indicate that the movement of glacial ice was toward the
(1) northeast and northwest  (3) southeast and northwest
(2) northeast and southwest  (4) southeast and southwest

21. Which mineral can be found in granite, andesite, gneiss, and hornfels?
(1) quartz  (3) olivine
(2) pyroxene  (4) biotite mica

22. Most igneous rocks form by which processes?
(1) melting and solidification
(2) heat and pressure
(3) erosion and deposition
(4) compaction and cementation

23. A seismographic station determines that its distance from the epicenter of an earthquake is 4,000 kilometers. If the P-wave arrived at the station at 10:15 a.m., the time of the earthquake’s origin was
(1) 10:02 a.m.  (3) 10:10 a.m.
(2) 10:08 a.m.  (4) 10:22 a.m.
24. The diagrams below represent four rock samples. Which rock took the longest time to solidify from magma deep within the Earth?

(1) Bands of alternating light and dark minerals

(2) Easily split layers of 0.0001-cm-diameter particles cemented together

(3) Glassy black rock that breaks with a shell-shape fracture

(4) Interlocking 0.5-cm-diameter crystals of various colors
25. The diagram below represents three seismograms showing the same earthquake as it was recorded at three different seismic stations, A, B, and C.

Which statement correctly describes the distance between the earthquake epicenter and these seismic stations?

(1) A is closest to the epicenter, and C is farthest from the epicenter.
(2) B is closest to the epicenter, and C is farthest from the epicenter.
(3) C is closest to the epicenter, and A is farthest from the epicenter.
(4) A is the closest to the epicenter, and B is the farthest from the epicenter.
26. Which seismogram was recorded approximately 4,000 kilometers from an earthquake epicenter?

Base your answers to questions 27 through 29 on the block diagrams below, which show three types of streams with equal volumes.

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

28. Explain why the outside of the curve of a meandering channel experiences more erosion than the inside of the curve.
30. State the general direction in which Cottonwood Creek is flowing.
31. State the highest possible elevation, to the nearest meter, for point B on the topographic map.

32. On the grid provided on your answer paper, draw a profile of the topography along line AB shown on the map.

33. In the space provided, calculate the gradient of the slope between points X and Y on the topographic map, following the directions below.

   a. Write the equation for gradient.
   b. Substitute data from the map into the equation.
   c. Calculate the gradient and label it with the proper units.

34. Base your answers to the following questions on the notes below written by a student during a field trip.

   It is cool in the shade, and the rock cliff above us still has some ice on it from winter. The rocks we are sitting on have sharp edges. Rock fragments at the bottom of the cliff are the same color as the cliff. Our teacher warned us to watch out for falling rocks.

   Explain how ice in cracks on the cliff at location C may have helped cause weathering of the bedrock on the face of the cliff.
A mountain is a landform with steeply sloping sides whose peak is usually thousands of feet higher than its base. Mountains often contain a great deal of nonsedimentary rock and have distorted rock structures caused by faulting and folding of the crust.

A plateau is a broad, level area at a high elevation. It usually has an undistorted, horizontal rock structure. A plateau may have steep slopes as a result of erosion.

State the agent of erosion that is most likely responsible for shaping the Catskill Plateau so that it physically resembles a mountainous region.
1. 2
2. 2
3. 3
4. 2
5. 2
6. 4
7. 4
8. 2
9. 3
10. 2
11. 1
12. 4
13. 1
14. 1
15. 4
16. 1
17. 4
18. 1
19. 2
20. 4
21. 1
22. 1
23. 2
24. 4
25. 3
26. 3

27. Responses include, but are not limited to: These tumbling cobbles and pebbles were abraded against other transported rocks and the stream channel; Abrasion occurred as the rocks bounced and rolled along the bottom of the streambed; Sharp corners and edges were knocked off, scraped, and/or worn down; Grinding against other sediment and rocks

28. Responses include, but are not limited to: Stream velocity is greater on the outside of the meandering channel; Stream flow is slower on the inside of the meandering channel; Water is moving faster on the outside of a meander curve

29. Responses include, but are not limited to: The type 3 stream meanders more; The type 3 stream occupies a wider floodplain; The type 1 stream has a straighter course.

30. Allow: E, NE or ENE

31. 599 or 599.0

32. 

33. a gradient = \(\frac{\text{(change in field value)}}{\text{(change in distance)}}\)
   
   \(\text{gradient} = \frac{\Delta \text{elevation}}{\Delta \text{distance}}\)

   \(b\) gradient = \(\frac{580 - 480}{2}\) or \(\frac{100}{2}\)
   
   \(c\) 50 meters/kilometer or 50 m/km

34. examples: – When liquid water freezes, it expands and breaks off pieces of rock. – frost action

35. Running water, streams, rivers or glaciers are all acceptable answers.