1. Sediment samples A through D below have the same volume and packing, but contain different percentages of various particle sizes.

Sample A: 75% clay and 25% silt
Sample B: 25% clay and 75% sand
Sample C: 50% pebbles and 50% sand
Sample D: 50% pebbles and 50% cobbles

Which sample most likely has the greatest permeability?
(1) A  (2) B  (3) C  (4) D

2. What is the approximate minimum stream velocity needed to keep a 6.4-cm-diameter particle in motion?
(1) 10 cm/s (2) 50 cm/s (3) 100 cm/s (4) 200 cm/s

3. Trees growing on the edge of a river’s meander are most likely to fall into the river due to
(1) deposition on the inside of the meander
(2) deposition on the outside of the meander
(3) erosion on the inside of the meander
(4) erosion on the outside of the meander

4. The photograph below shows a sandstone butte in an arid region.

Which agents of erosion are currently changing the appearance of this butte?
(1) glaciers and mass movement
(2) wave action and running water
(3) wind and mass movement
(4) running water and glaciers

5. Sediment is deposited in a river delta because the
(1) velocity of the river decreases
(2) force of gravity decreases
(3) volume of the river increases
(4) gradient of the river increases
Base your answers to questions 6 through 8 on the passage below and on your knowledge of Earth science.

**Ice Ages**

Earth has undergone many ice ages, each lasting millions of years. Some scientists infer that most ice ages were caused by landmasses blocking the ocean currents between equatorial regions and the poles. Ice ages usually ended when the positions of continents allowed ocean currents to resume transporting equatorial heat to the poles.

During each ice age there were advances and retreats of glaciers. These cool glacial and warm interglacial climate intervals were caused mostly by changes in Earth's orbit and tilt. Earth is presently in a warm interglacial interval.

6. Earth’s warm interglacial intervals are due primarily to
   (1) changes in Earth’s period of rotation
   (2) changes in Earth’s orbit and tilt
   (3) increases in elevation of North America
   (4) divergence at the Mid-Atlantic Ridge

7. Approximately 359 million years ago, the average intensity of insolation received in a year by the land area that is now eastern North America was likely
   (1) greater, because eastern North America was at a lower latitude
   (2) greater, because eastern North America was at a higher latitude
   (3) less, because eastern North America was at a lower latitude
   (4) less, because eastern North America was at a higher latitude

8. Evidence that glaciers covered large areas of New York State is best provided by
   (1) long-term temperature measurements
   (2) folded layers of bedrock
   (3) kettle lakes and drumlins
   (4) the presence of streams and rivers

9. The photograph below shows a valley.

![Valley Image]

Which agent of erosion most likely produced this valley’s shape?
   (1) blowing wind
   (3) moving ice
   (2) ocean waves
   (4) running water

10. Pieces of bedrock material that are broken from a cliff and deposited by a landslide at the base of the cliff are best described as
    (1) rounded and sorted
    (2) rounded and unsorted
    (3) angular and sorted
    (4) angular and unsorted
11. Describe one piece of evidence likely to be found on the exposed bedrock surfaces that could indicate the direction this glacier moved.

Striations (scratches in the rock)

12. Describe one difference between the arrangement of sediment in the moraines and the arrangement of sediment in the outwash plain.

Moraines - unsorted
Outwash Plain - sorted

13. Describe the most likely shape of the valley being formed due to erosion by this glacier.

U-Shaped!

14. Explain why the glacial ice absorbs less solar radiation than the surrounding exposed bedrock and soil.

Because it is light colored and smooth.

15. Sandstone, limestone, and conglomerate cobbles are found in a streambed in New York State where the surrounding bedrock is composed of shales and siltstones. The most likely explanation for the presence of these cobbles is that they were
(1) weathered from the surrounding bedrock
(2) formed when shale and siltstone bedrock were eroded
(3) transported to this area from another region
(4) metamorphosed from shale and siltstone
Base your answers to questions 21 through 24 on the diagram below and on your knowledge of Earth science. The diagram represents a portion of a stream and its surrounding bedrock. The arrows represent the movement of water molecules by the processes of the water cycle. The water table is indicated by a dashed line. Letter A represents a water cycle process occurring at a specific location. Letter d represents the distance between the water table and the land surface.

21. Identify water cycle process A, which produces cloud droplets.

22. Describe the soil permeability and the land surface slope that allow the most infiltration of rainwater and the least runoff.

23. Slightly acidic groundwater has been seeping through cracks and openings in the limestone bedrock of this area, producing caves. State whether the type of weathering that produces these caves is mainly chemical or physical, and identify one characteristic of limestone that allows this type of weathering to occur.

24. Explain why the distance, d, from the water table to the land surface would decrease after several days of heavy rainfall.

The water table (level of groundwater) would go up, causing distance d to decrease.
Base your answers to questions 25 through 28 on the map below and on your knowledge of Earth science. The map shows the location of Sandy Creek, west of Rochester, New York. X and Y represent points on the banks of the stream.

25. Draw a line below to represent the shape of the stream bottom from point X to point Y.

26. Explain why sediments are deposited when Sandy Creek enters Lake Ontario.

   The velocity of the creek decreases.

27. Record the minimum velocity this stream needs to transport a 2.0-cm-diameter particle.

   100 cm/s
28. The symbols representing four sediment particles are shown in the key in your answer booklet. These particles are being transported by Sandy Creek into Lake Ontario. On the cross section below, draw the symbols on the bottom of Lake Ontario to show the relative position where each sediment particle is most likely deposited.

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
</tr>
<tr>
<td>△</td>
</tr>
<tr>
<td>○</td>
</tr>
<tr>
<td>×</td>
</tr>
</tbody>
</table>

![Diagram of Sandy Creek and Lake Ontario with symbols]

(Not drawn to scale)

29. A landslide is an example of
   (1) river deposition  (3) mass movement
   (2) glacial scouring  (4) chemical weathering

30. Each of the rock particles below has the same density and volume. Which particle will most likely settle at the fastest rate in moving water?

![Particles (1), (2), (3), (4)]

31. Which rock weathers most rapidly when exposed to acid rain?
   (1) quartzite  (3) basalt
   (2) granite    (4) limestone

32. What is the approximate minimum stream velocity needed to keep a particle in motion that has a diameter of 10 centimeters?
   (1) 110 cm/s  (3) 325 cm/s
   (2) 190 cm/s  (4) 425 cm/s

(use back cover to find calcite reacts w/acid, then use the rock charts, pg. 7.)
51. The diagram below represents three identical beakers filled to the same level with spherical beads.

If the packing of the beads within each beaker is the same, which graph best represents the porosity within each beaker?

52. Which graph shows the general relationship between soil particle size and the capillarity of the soil?
53. The diagram below represents the setup for an experiment for studying groundwater. Tubes A, B, C, and D contain equal volumes of sediments. Within each tube, the sediments are uniform in size, shape, and packing. A test for water retention was conducted by first filling each tube with water and then draining the water into beakers.

Which graph represents the general relationship between the sediment size and the amount of water retained by the sediments after the tubes had drained?

Base your answers to question 54 on the passage below.

**Meteorite Composition**

Meteors that strike Earth’s surface are called meteorites. Analysis of meteorite composition has provided scientists with information regarding the formation of Earth and our solar system, and possibly the development and evolution of life on Earth.

Two types of meteorites are iron meteorites and chondrites. Iron meteorites consist mostly of iron and nickel, and are inferred to be from core materials of early planetary bodies in our solar system. More than 60% of meteorites studied have been identified as chondrites. Chondrites are made of millimeter-sized spheres of olivine and pyroxene crystals embedded in a mass of mineral and metal grains. The chondrites are thought to represent fragments of the earliest solid materials in our solar system. One type of chondrite, the carbonaceous chondrite, contains water, organic compounds, and minerals that represent the chemical composition necessary for life to form.

54. Explain why there is little evidence of meteorite impact craters on Earth.
Base your answers to questions 60 and 61 on the diagram and data table below. The diagram shows the equipment used to determine the factors affecting the rate of erosion in a stream. The data table shows the time it took a 10-gram sample of quartz sand to move 100 centimeters down the rain gutter under various conditions.

![Diagram of equipment used to determine the rate of erosion in a stream.](image)

**Data Table**

<table>
<thead>
<tr>
<th>Rain Gutter Slope</th>
<th>Water Velocity</th>
<th>Erosion Time (s)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Fine Sand</td>
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<tr>
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<tr>
<td>10°</td>
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<td></td>
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</tr>
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<td>10</td>
</tr>
<tr>
<td></td>
<td>fast</td>
<td>5</td>
</tr>
</tbody>
</table>

61. In this experiment, the water velocity could be increased by
(1) decreasing the slope of the rain gutter
(2) increasing the amount of water from the faucet
(3) lowering the flexible hose
(4) widening the rain gutter

62. What is the relationship between the water velocity and the rate of erosion?
(1) If the water velocity decreases, the rate of erosion increases.
(2) If the water velocity increases, the rate of erosion increases.
(3) If the water velocity remains constant, the rate of erosion decreases.
(4) If the water velocity remains constant, the rate of erosion increases.