1. The cross section below shows the movement of wind-driven sand particles that strike a partly exposed basalt cobble located at the surface of a windy desert.

Which cross section best represents the appearance of this cobble after many years of exposure to the wind-driven sand?

A) chemical weathering  
B) deposition  
C) erosion  
D) physical weathering

2. The diagram below shows the stump of a tree whose root grew into a small crack in bedrock and split the rock apart.

The action of the root splitting the bedrock is an example of

A) chemical weathering  
B) deposition  
C) erosion  
D) physical weathering

3. By which processes are rocks broken up and moved to different locations?

A) evaporation and condensation  
B) weathering and erosion  
C) burial and cementation  
D) compaction and transportation

4. Which process involves either a physical or chemical breakdown of earth materials?

A) deposition  
B) sedimentation  
C) weathering  
D) cementing

5. Which event is an example of chemical weathering?

A) rocks falling off the face of a steep cliff  
B) feldspar in granite being crushed into clay-sized particles  
C) water freezing in cracks in a roadside outcrop  
D) acid rain reacting with limestone bedrock
Base your answers to questions 6 through 9 on the laboratory experiment described below.

The weathering of four different rock samples with different masses was studied. Each rock sample was placed in a separate beaker containing 500 milliliters of a dilute acid for 10 minutes. Bubbling was observed in some of the beakers. The data table below shows the mass of each sample, in grams, before placement in the acid and after removal from the acid.

### Data Table

<table>
<thead>
<tr>
<th>Rock</th>
<th>Mass Before (g)</th>
<th>Mass After (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>limestone</td>
<td>19.72</td>
<td>19.64</td>
</tr>
<tr>
<td>granite</td>
<td>20.77</td>
<td>20.77</td>
</tr>
<tr>
<td>gneiss</td>
<td>26.83</td>
<td>26.83</td>
</tr>
<tr>
<td>marble</td>
<td>20.81</td>
<td>20.73</td>
</tr>
</tbody>
</table>

6. Which property of the gneiss sample prevented it from weathering?
   A) crystalline texture  B) mineral composition  C) density  D) cleavage

7. Approximately what percentage of the marble sample remained after the experiment?
   A) 0.4%  B) 8.0%  C) 20.7%  D) 99.6%

8. Which table correctly shows the classification of the rock samples based on the amount of weathering during this experiment?
   A) ![Group A: limestone, marble; Group B: granite, gneiss]
   B) ![Group A: limestone, granite, gneiss; Group B: marble]
   C) ![Group A: limestone; Group B: granite, marble, gneiss]
   D) ![Group A: limestone, granite; Group B: gneiss, marble]

9. Which Earth process is being modeled in this experiment?
   A) physical weathering in the hydrosphere  B) physical weathering in the mesosphere
   C) chemical weathering in the hydrosphere  D) chemical weathering in the mesosphere
10. The generalized cross section below shows the sedimentary rock layers at Niagara Falls in western New York State.

Which rock layer appears to be most resistant to weathering and erosion?
A) Lockport dolostone
B) Rochester shale
C) Grimsby sandstone
D) Queenston shale

11. Sediments found in glacial moraines are best described as
A) sorted and layered
B) sorted and not layered
C) unsorted and layered
D) unsorted and not layered

12. What is the best evidence that a glacial erratic has been transported?
A) It is located at a high elevation in a mountainous area.
B) It is less than 25 centimeters in diameter.
C) Its composition is different from that of the bedrock under it.
D) It appears to have been intensely metamorphosed.

13. Which erosional force acts alone to produce avalanches and landslides?
A) gravity
B) winds
C) running water
D) sea waves

14. The photograph below shows an arch of rock located in the western United States.

How did the arch most likely form?
A) The bedrock in the arch was more resistant to weathering and erosion than the surrounding bedrock that was removed.
B) An earthquake forced bedrock upward into the shape of an arch.
C) Sand and gravel were deposited and compacted in the shape of an arch.
D) An underground glacier tunneled through the bedrock.

15. What change will a pebble usually undergo when it is transported a great distance by streams?
A) It will become jagged and its mass will decrease.
B) It will become jagged and its volume will increase.
C) It will become rounded and its mass will increase.
D) It will become rounded and its volume will decrease.

16. Which rock material was most likely transported to its present location by a glacier?
A) rounded sand grains found in a river delta
B) rounded grains found in a sand dune
C) residual soil found on a flat plain
D) unsorted loose gravel found in hills
17. Base your answer to the following question on the diagram below, which represents the landscape features associated with a meandering river. Letters $W$, $X$, $Y$, and $Z$ represent locations on the floodplain.

![Diagram of meandering river landscape features]

During transport by this river, a sediment particle will most likely become

A) more rounded  B) more dense  C) heavier  D) larger

18. The demonstration shown in the diagram below indicates that powdered limestone reacts faster than a single large piece of limestone of equal mass when both are placed in acid.

![Diagram of limestone and powdered limestone experiments]

The most likely reason powdered limestone reacts faster is that it has

A) less total volume  B) more chemical bonds  C) more total surface area  D) lower density

19. Which cross section best represents the valley shape where a rapidly flowing stream is cutting into the bedrock in a mountainous area?

![Cross section options]

20. The photograph below shows a sand dune that formed in a coastal area.

![Sand dune photograph]

This sand dune was most likely formed by

A) water flowing from the left  B) water flowing from the right  C) wind blowing from the left  D) wind blowing from the right
21. The diagrams below represent four different examples of one process that transports sediments.

Which process is shown in these diagrams?

A) chemical weathering  
B) wind action  
C) mass movement  
D) rock abrasion

22. The block diagram below represents an igneous dome that uplifted overlying rock layers, which were then weathered and eroded.

Which stream drainage pattern is most likely found on the surface of the area represented by the block diagram?

A)  
B)  
C)  
D)

23. What is the largest sediment that can be transported by a stream that has a velocity of 125 cm/sec?

A) cobbles  
B) pebbles  
C) sand  
D) clay

24. What is the approximate minimum stream velocity needed to keep a particle in motion that has a diameter of 10 centimeters?

A) 110 cm/s  
B) 190 cm/s  
C) 325 cm/s  
D) 425 cm/s
25. The cross section below represents a portion of a meandering stream. Points X and Y represent two positions on opposite sides of the stream. Based on the cross section, which map of a meandering stream best shows the positions of points X and Y?

A)  

![Map A](image1)

B)  

![Map B](image2)

C)  

![Map C](image3)

D)  

![Map D](image4)

26. Base your answer to the following question on the diagram below, which shows ocean waves approaching a shoreline. A groin (a short wall of rocks perpendicular to the shoreline) and a breakwater (an offshore structure) have been constructed along the beach. Letters A, B, C, D, and E represent locations in the area. At which location will the beach first begin to widen due to sand deposition?

A) A  

B) B  

C) C  

D) E

27. Diagram I below shows a laboratory setup for observing the settling pattern in water of sediments composed of the same mineral. When the sediments in the container were poured into the tube of water, they settled to the bottom in the pattern shown in diagram II below. [Diagram II is enlarged to show the sedimentary particles.]

Which characteristic of the sedimentary particles most likely caused the pattern of deposition shown in diagram II?

A) particle shape  

B) particle size  

C) particle composition  

D) particle density
Pratice Surface Processes Test

Base your answers to questions 28 through 31 on the reading passage below and on your knowledge of Earth science.

**Roche Moutonée**

A roche moutonée is a glacial landscape feature produced as an advancing glacier slides over a hill of surface bedrock. As the glacier advances up the side of the hill, the surface bedrock is abraded and smoothed by rock fragments carried within the base of the glacial ice, creating a more gentle hillslope. As the glacier advances down the opposite side of the hill, chunks of bedrock are broken off and removed by the ice, a process called glacial quarrying (plucking), making this side of the hill steeper. The resulting hill resembles a drumlin, except it is often smaller and is composed of solid rock.

28. The chunks of bedrock removed by glacial quarrying and transported by the glaciers most likely produce
   A) terminal outwash plains  B) kettle lake depressions
   C) V-shaped valleys         D) parallel scratches in surface bedrock

29. A drumlin differs from a roche moutonée because a drumlin is
   A) formed by glaciers       B) dome shaped
   C) deposited by glacial meltwater  D) composed of loose sediments

30. Which side-view model best shows the direction of ice movement and the locations of glacial abrasion and glacial quarrying that form a roche moutonée?

<table>
<thead>
<tr>
<th>A = Glacial abrasion</th>
<th>Q = Glacial quarrying</th>
</tr>
</thead>
<tbody>
<tr>
<td>A)</td>
<td>B)</td>
</tr>
<tr>
<td>![Diagram A]</td>
<td>![Diagram B]</td>
</tr>
<tr>
<td>C)</td>
<td>D)</td>
</tr>
<tr>
<td>![Diagram C]</td>
<td>![Diagram D]</td>
</tr>
</tbody>
</table>

31. The formation of a roche moutonée by glaciers is best described as an example of
   A) chemical weathering  B) physical weathering
   C) sediment deposition  D) mass movement
32. Base your answer to the following question on the diagram below, which shows a coastal region in which the land slopes toward the ocean. Point \( X \) is near the top of the hill, point \( Y \) is at the base of the hill, and point \( Z \) is a location at sea level. The same type of surface bedrock underlies this entire region. A stream flows from point \( X \) through point \( Y \) to point \( Z \). This stream is not shown in the diagram.

Which cross section best shows the pattern of sediments deposited by the stream as it enters the ocean near point \( Z \)?

A) ![Cross section A](image)

B) ![Cross section B](image)

C) ![Cross section C](image)

D) ![Cross section D](image)
33. The cross sections below show a three-stage sequence in the development of a glacial feature.

![Cross sections](image)

Which glacial feature has formed by the end of stage 3?

A) kettle lake  
B) finger lake  
C) drumlin  
D) parallel scratches

34. The two pebbles shown below are dropped into a tank of water 1 meter deep.

<table>
<thead>
<tr>
<th>Material</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematite</td>
<td>6.5</td>
</tr>
<tr>
<td>Quartz</td>
<td>2.6</td>
</tr>
</tbody>
</table>

![Pebbles](image)

Why does the hematite pebble settle faster than the quartz pebble?

A) Smaller objects settle faster than larger objects.  
B) Flat objects settle faster than round objects.  
C) Spherical objects have less gravitational attraction than flat objects.  
D) Objects with higher density settle faster than objects with lower density.

35. Which diagram best represents a cross section of a valley which was glaciated and then eroded by a stream?

A) ![Diagram A](image)  
B) ![Diagram B](image)  
C) ![Diagram C](image)  
D) ![Diagram D](image)

36. The diagram below shows a portion of a stream.

![Stream diagram](image)

The sand bars formed as a direct result of

A) erosion due to a decrease in stream velocity  
B) erosion due to an increase in stream velocity  
C) deposition due to a decrease in stream velocity  
D) deposition due to an increase in stream velocity

37. Which statement best describes the conditions existing at a stream location where the erosional-depositional system is in dynamic equilibrium?

A) More erosion than deposition takes place.  
B) More deposition than erosion takes place.  
C) Equal amounts of erosion and deposition take place.  
D) No erosion or deposition takes place.
38. Base your answer to the following question on the map below.

Toward which direction is sand being transported along the shoreline within the zone of breaking waves?

A) northeast  B) south  C) southeast  D) west

39. The map below shows a meandering stream. Points A, B, C, and D represent locations along the stream bottom.

At which location is the greatest amount of sediment most likely being deposited?

A) A  B) B  C) C  D) D

40. The diagrams below show gradual stages 1, 2, and 3 in the development of a river delta where a river enters an ocean.

Which statement best explains why the river delta is developing at this site?

A) The rate of deposition is less than the rate of erosion.
B) The rate of deposition is greater than the rate of erosion.
C) Sea level is slowly falling.
D) Sea level is slowly rising.
Answer Key
Surface Processes Practice Test

1. **B**  
2. **D**  
3. **B**  
4. **C**  
5. **D**  
6. **B**  
7. **D**  
8. **A**  
9. **C**  
10. **A**  
11. **D**  
12. **C**  
13. **A**  
14. **A**  
15. **D**  
16. **D**  
17. **A**  
18. **C**  
19. **D**  
20. **D**  
21. **C**  
22. **D**  
23. **B**  
24. **B**  
25. **D**  
26. **B**  
27. **B**  
28. **D**  
29. **D**  
30. **A**  
31. **B**  
32. **C**  
33. **A**  
34. **D**  
35. **D**  
36. **C**  
37. **C**  
38. **D**  
39. **C**  
40. **B**