Questions 6-24 WILL be on the final exactly as written here; this is 60% of the test.

1. Sketch a map view of three types of deltas showing the differences in river, wave and tidal influences on delta morphology. Label the features that make them different or describe them in a list. List 3 types of cross stratification you would see in each and use arrows to indicate where each is likely to form. (9 points)

2. One of the following stratigraphic sections represents a turbidite flow and one represents a storm deposit. Each stratigraphic column represents a single event followed by the slow accumulation of background sedimentation of shale. List the process or flow regime that produced the sedimentary structures in each segment and label each with the appropriate depositional event. (6 points)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Lithology</th>
<th>Mud Sand Gravel</th>
<th>Texture (Sorting, color, sedimentary structures, fossils, etc.)</th>
<th>Process Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 cm</td>
<td></td>
<td></td>
<td>Bioturbation</td>
<td></td>
</tr>
<tr>
<td>20 cm</td>
<td></td>
<td></td>
<td>Faint Planar Lamination Current ripples</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Planar Lamination</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Sole Marks</td>
<td></td>
</tr>
<tr>
<td>0 cm</td>
<td></td>
<td></td>
<td>Bioturbation</td>
<td></td>
</tr>
</tbody>
</table>

Depositional Event for above column:
How does flow speed change through time?

<table>
<thead>
<tr>
<th>Scale</th>
<th>Lithology</th>
<th>Mud Sand Gravel</th>
<th>Texture (Sorting, color, sedimentary structures, fossils, etc.)</th>
<th>Process Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 cm</td>
<td></td>
<td></td>
<td>Bioturbation</td>
<td></td>
</tr>
<tr>
<td>20 cm</td>
<td></td>
<td></td>
<td>Wave ripples on top of bed</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hummocky X-strat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Faint Laminae Sole Marks</td>
<td></td>
</tr>
<tr>
<td>0 cm</td>
<td></td>
<td></td>
<td>Bioturbation</td>
<td></td>
</tr>
</tbody>
</table>

Depositional Event for above column:
How does flow speed change through time?
3. a) The following photo has a feature characteristic of tidal environments. Mark it on the photo and give it a name. (2 points)

![Photo of tidal environment feature](image)

b) What are two other sedimentary structures characteristic of tidal environments? Sketch and label each of them. (4 points)

4. The following sketch shows how storm deposits vary from near shore to deeper water. For each column, mark an erosion surface that represents the bottom of a storm deposit. Put an “F” next to beds that were deposited quickly, and put an “S” next to beds that were deposited slowly. (6 points)

![Storm deposit sketch](image)
5. List the grain size and a characteristic sedimentary structure for each of the environments labeled in the following sketch. (8 points)

<table>
<thead>
<tr>
<th>Site</th>
<th>Grain Size (mud, fine sand, or coarse sand)</th>
<th>Sedimentary Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Choose 3 sedimentary environments from this list:
Braided river
Meandering river
Aeolian dunes
Alluvial Fan
Beach and foreshore

Choose from:
Storm-influenced Delta
Tide-influenced Delta
River Dominated Delta
Submarine turbidite fan
Glacier ending in the ocean

Answer the questions on the following pages for each environment (20 points for each environment as listed below)

Name of Environment 1: (0 points)

6. Draw a sketch of your chosen environment showing the different fluids and flows (3 points).

7. List each flow type (e.g. ice, debris flow, flowing water, standing water, etc.) Is the flow for each of the fluids turbulent or laminar? Why is each flow turbulent or laminar? Answer the second question in reference to the variables in the Reynolds number equation (3 points)

8. Describe how the flow varies in speed in space and/or time? (2 points)

9. What are approximate grain sizes that would be transported in the various parts of this environment, and which mechanisms (e.g. in suspension, saltation, bedload, etc.) are transporting the different grain sizes if there is a range in grain size? (4 points)

10. Where are the sediments deposited in the environment, and what conditions promote or are required for their deposition? (e.g. how do variations in flow speed influence where sediments are deposited, how do these variations change relative to the depositional environment, etc.) (4 points)

11. Describe the sedimentary structures that form in the environment. Include uniquely identifying features as well as a typical vertical sequence of structures if there is one. Feel free to make a sketch of a representative stratigraphic column or cross section to help highlight these features. (4 points)
Name of Environment 2: (0 points)

12. Draw a sketch of your chosen environment showing the different fluids and flows (3 points).

13. List each flow type (e.g. ice, debris flow, flowing water, standing water, etc.) Is the flow for each of the fluids turbulent or laminar? Why is each flow turbulent or laminar? Answer the second question in reference to the variables in the Reynolds number equation (3 points)

14. Describe how the flow varies in speed in space and/or time? (2 points)

15. What are approximate grain sizes that would be transported in the various parts of this environment, and which mechanisms (e.g. in suspension, saltation, bedload, etc.) are transporting the different grain sizes if there is a range in grain size? (4 points)

16. Where are the sediments deposited in the environment, and what conditions promote or are required for their deposition? (e.g. how do variations in flow speed influence where sediments are deposited, how do these variations change relative to the depositional environment, etc.) (4 points)

17. Describe the sedimentary structures that form in the environment. Include uniquely identifying features as well as a typical vertical sequence of structures if there is one. Feel free to make a sketch of a representative stratigraphic column or cross section to help highlight these features. (4 points)

18. Discuss how one could distinguish sediments deposited in the two depositional environments you described above. Use specific information such as grain size variations, differences in sedimentary structures, vertical changes in facies, etc. to highlight the differences. This section should use, can refer to, and will repeat some of the information in the earlier questions. (5 points)

Name of Environment 3: (0 points)

19. Draw a sketch of your chosen environment showing the different fluids and flows (3 points).

20. List each flow type (e.g. ice, debris flow, flowing water, standing water, etc.) Is the flow for each of the fluids turbulent or laminar? Why is each flow turbulent or laminar? Answer the second question in reference to the variables in the Reynolds number equation (3 points)

21. Describe how the flow varies in speed in space and/or time? (2 points)
22. What are approximate grain sizes that would be transported in the various parts of this environment, and which mechanisms (e.g. in suspension, saltation, bedload, etc.) are transporting the different grain sizes if there is a range in grain size? (4 points)

23. Where are the sediments deposited in the environment, and what conditions promote or are required for their deposition? (e.g. how do variations in flow speed influence where sediments are deposited, how do these variations change relative to the depositional environment, etc.) (4 points)

24. Describe the sedimentary structures that form in the environment. Include uniquely identifying features as well as a typical vertical sequence of structures if there is one. Feel free to make a sketch of a representative stratigraphic column or cross section to help highlight these features. (4 points)
25. The following stratigraphic columns represent a sequence of rocks deposited during changes in depositional environments. Choose one column, interpret the processes that deposited the sediment. Please include the ways sediment was transported (i.e. bedload, suspension, in a laminar/turbulent flow, by wind/water/ice). (3 points)
26. Draw a simple sketch that illustrates the processes that deposited the sediment in the environments represented by the stratigraphic column you chose and show the spatial relationship among the environments. Label the environments on your sketch. (2 points)

27. The following stratigraphic columns represent a sequence of rocks deposited during changes in depositional environments. Choose one column, interpret the processes that deposited the sediment. Please include the ways sediment was transported (i.e. bedload, suspension, in a laminar/turbulent flow, by wind/water/ice). (3 points)
28. Draw a simple sketch that illustrates the processes that deposited the sediment in the environments represented by the stratigraphic column you chose and show the spatial relationship among the environments. Label the environments on your sketch. (2 points)

29. Does the following delta represent a river-dominated, wave-influenced, or tide-influenced delta? Why? (2 points)
30a. What type of weathering tends to most often produce grains of the following types? Choose one of these answers: Chemical Weathering, Physical Weathering, or Both (3 points)

a) quartz sand

b) Ca-feldspar or olivine sand

c) clay-sized clay minerals

30b. In a warm humid climate, what type of sediment would you predict from weathering of a mafic rock composed of olivine, pyroxene, and plagioclase (Ca-feldspar)? Include both grain size and composition. (2 points)

30c. In a cold climate, what type of sediment would you predict from weathering of an ancient sequence of sandstone? Include both grain size and composition. (2 points)

31. What characterizes sediments deposited by glacial processes? You can include associations with sediments from neighboring environments. (5 points for 5 items)

32. If sea level went up, how would sediment deposition change at points A, B and C in the following diagram? (5 points)

![Diagram of glacier and ice berg]

33. The following stratigraphic column represents a sequence of rocks deposited during a change in depositional environments. First there was erosion of igneous rocks; then rocks were deposited in a fining upward sequence.
a) Next to the stratigraphic column, interpret the processes that deposited the sediment for the three sedimentary rock types (diamictite, sandstone, and shale). Please include the way sediment was transported (i.e. bedload, suspension, in a laminar/turbulent flow, by wind/water/ice) and how it was deposited (i.e. by migration of a bedform, settling out, etc.). (4 points)

b) Draw a simple sketch that illustrates the processes that deposited the sediment in both environments and shows the spatial relationship among the two environments and the erosional area, i.e. where they were located relative to each other. (Remember that Walther’s Law says that environments that grade into each other vertically in a stratigraphic section occur next to each other.) Label the environments on your sketch (erosion, #1 and #2). Make sure that the processes that you described in part a are included in your sketch! (6 points)

35. What characterizes sediment deposited on an alluvial fan? You can include associations with sediments from neighboring environments. (5 points for 5 items)

36. What characterizes sediment deposited in a playa lake environment? You can include associations with sediments from neighboring environments. (5 points for 5 items)

37. If you observe meter-high cross stratification in fine sand, what environment would you predict that the sand was deposited in? Why? (3 points)

38. In the following two stratigraphic columns, the bars represent the range of fossils 1, 2, ... 12 (bold numbers). The numbers written sideways represent the location in the
stratigraphic column where the fossil was first and last observed. The bentonite bed is a volcanic ash. Show three time correlations between the two columns and describe the features you used to make that correlation and why they suggest a time correlation. (6 points) (On the test, I may include columns with magnetic reversals in addition to the biostratigraphy.)

Correlation A:

Correlation B:

Correlation C:

39. Is the following picture more likely to show ripple x-lamination or dune x-stratification? Why? What type of flow produced it? (2 points; the hand lens is 2 cm across)
40. The following diagram shows the topography along which a river flows after it leaves the mountains. Part of the river is a braided river and part is a meandering river. (3 points; 1 point each)

![Diagram of river topography]

a) Which segment of the river is most likely to be braided? A or B

b) Which segment is most likely to be meandering? A or B

c) Which segment of the river will be transporting the coarsest sediment? A or B