Final Examination

Please respond to Question 1 but ONLY seven of the other question sets. You will find it will assist you greatly to organize your thoughts before you begin to write - scratch paper will be provided for this purpose, and you may discard or take this with you (no, it needn't be turned in). In all cases, please be as thorough but concise in your responses as you can. Please respond to all questions in complete sentences and proper English.

Please avoid cryptic notation such as "w/", "w/o", "b/c" etc.

It doesn't take THAT much additional work to write the words out properly, and makes it SO much easier to read what you've written 😊.

Please present all of your responses in the blue book(s) provided. And PLEASE try to remember that I can't give credit for anything I can't read! PLEASE label specific items on any photos from the exam to which you refer in your responses, such that there can be no question as to what you are discussing.

You have a space limit of two exam booklets for this exam, and it SHOULD be something you should be able to complete in two hours or so. However, if you need additional time, you can have it, but if you're still writing at three hours you should ask whether you are well-served by continuing longer.

Each question set is worth 25 points; the exam as a whole, then, is worth 200 out of your semester total.

"Perhaps the most valuable result of all education is the ability to make oneself do the thing one has to do, when it ought to be done, whether one likes it or not; it is the first lesson that ought to be learned [but] probably the last lesson that is learned thoroughly."

- T. H. Huxley
PLEASE READ ALL QUESTIONS VERY CAREFULLY!

Please respond to Question 1 but ONLY seven of the remaining question sets.

☛ Please ensure that your responses address the questions asked. Note also that "discuss" means I am looking for a discussion of at least a paragraph in length, not a quick one-word or one-line response. Feel free to utilize sketches (diagrams) if you feel they can assist in presenting a clear response in any case.

1. Discuss the major points of one of your classmates’ presentations from EACH of the two following lists (i.e., you must discuss one presentation from each list), excluding your own. Include ALL major points and a summary of the subject matter. (2 @ 12.5 pts. each)

**List 1:**
- Oriana Battifarano: Geologic History of Long Island and the Sedimentary Processes Active on the Southern Shore
- Cassandra Biette: Geologic Origins and Geomorphology of the Great Lakes
- Sarah Evans: Coastal Processes and Geomorphology between Boston and Scituate, Massachusetts
- Zach Hartnett: Bedrock and Glacial Control on the Geomorphology of the Green Mountains of Vermont
- Tyler Lewtan: Geologic History and Geomorphology of the Moosehead Lake Region, Maine
- Megan Mackenzie: Coastal Processes and Geomorphology of the California Coast from Monterey to San Simeon

**List 2:**
- Ariana Boyd: Geomorphology of Venus
- Ben Csiernik: Effects of Wildfires on Landscape Evolution in Southern California
- Paco DiFrancis: Post-Glacial Geomorphological History of Glacial Lake Hitchcock in the Connecticut River Valley
- Sarabath George: El Niño and La Niña – Impacts on global climate and geomorphic systems
- Patt Lamom: Geological History and Geomorphology of the Mountains of Northern Thailand
- June Li: Geology, History and Geomorphology of Changbaishan Volcano Area, China-Korea
- Kel Mitchell: Geologic and Geomorphologic History of the Santa Barbara Region, Southern California
- Kam Olaugun: The Geologic History and Geomorphology of the Ko Phi Phi Islands, Thailand
- Casey Romeo: Coastal and Eolian Processes of the Outermost Tip of Cape Cod (Provincetown)
- Calvin Wight: Volcanism and Volcanic Landforms of Lake County, California

2. How do stream terraces form, and what can they tell you about the past geologic history of an area? Relate this to the study of the Aguas and Feos river drainages in Spain, as discussed by Harvey and Wells (reference on next page). How does the origin of typical stream terraces differ from the mode of formation of typical marine terraces? (25 points)

3. Compare and contrast 2:1 and 1:1 clays, based on both their chemistry and structure. Which are more likely to be created by chemical weathering processes in moist environments (e.g., the eastern U.S.A.), and which are more likely to be weathering products in seasonally dry climates such as those that characterize the American West, and why? Which is more likely to create structural problems for buildings, and result in greater landscape instability, and why? What is C.E.C., and why is it significant for both agriculture and the purification of subsurface waters in the geologic environment? (25 points)

4. What is loess, and what are two major geological environments that can yield sediment that ultimately will become loess? Identify four major reasons why loess is an outstanding parent material for rich agricultural soils. What was the evidence for recent groundwater seepage on Mars, as discussed in the paper by Malin and Edgett (reference on next page)? (25 points)
5. What is the significance of the global $\delta^{18}O$ record to our understanding of climate change over the past 3 million years or so? What is the natural range of variation in CO$_2$ over the past 700,000 years, based on analysis of gas bubbles trapped in Antarctic glacial ice? What is the current concentration of CO$_2$ in the world's atmosphere, and what does that bode for future global ice volumes, and why?

6. What's are the major differences between till and outwash, and between end moraines and terminal moraines? How was Long Island formed in New York? How is this differentiated from the formation of Cape Cod in Massachusetts? Identify and describe four major features created by glacial erosion, as opposed to glacial deposition, including how they have been created.

7. Describe the processes involved in the solution of calcite-based limestone to produce karst environments, including the specific chemistry involved in the process. Don't forget to include the critical role that carbon dioxide plays in the environment in this discussion, and why caves form at or near the water table. What are five key factors in the geological substrate that will increase the likelihood of karst formation? What problems did Coron identify in the Johnson City, Tennessee, area that resulted from development in a karst area?

8. Describe the processes active in maintaining longshore drift (= littoral drift) along a coastline, and describe how this builds spits and can potentially yield offshore barrier islands. How does construction of groins along a coastline (e.g., New Jersey) affect this process, and what are potential repercussions, both positive and negative? Use sketches if they will assist you in clarifying your response. How did the construction of the jetties at Saco and Wells Beach, Maine, affect longshore sediment transport, as discussed in the paper by Kelley and Anderson (reference below)?

[Outside reading references.]

Note that these remaining questions are based on Google Earth imagery. PLEASE ask for help if anything is unclear to you in the images – these are admittedly not as sharp and crisp as real photos. Note also that it is absolutely critical that you NOT make any assumptions about where a particular photo was taken, unless I tell you where it is. Each of the following photo-question sets is worth 25 points.

9. Consider the following Google Earth oblique image of the Oregon coast. [The brown areas just right of center, with the straight-edge margins, are clear-cuts in the forest.]

☛ Describe thoroughly the coastal processes that are active on the left and right sides of the image, and contrast these with what is going on in the central region. Why are these areas so different? Why is the coastline itself, overall, so steep? (This is only a 1.5x vertical exaggeration.)
10. What factors and processes were involved in creating the unusual character of this coastline from SE Alaska, shown in a vertical Google Earth image (from a vantage point of 18 km [~11 miles] up in the air)?

![Image of coastline from SE Alaska](image1.png)

11. Describe thoroughly the major features that are shown in the following Google Earth image, including what the features are, of what they are composed (be as specific as possible) and their mode of origin. The sharp line running obliquely across the image from NW to SE is a water diversion canal (followed by an unpaved road that is less distinctly visible). Would you expect any impact between these features in the future – the landforms and canal - and if so, what would it be? Why or why not?

![Image of water diversion canal](image2.png)
12. What is this particular kind of topography in South Dakota called? What does it tell you about the underlying geology, and what specific kind(s) of materials would you expect to underlie this area?

13. You have an opportunity to purchase, for a good price, a summer vacation home at the location shown in the photo below. It is accessible from a major highway, has a built-in pool, is next to an outstanding fishing stream, and has a marvelous view. Discuss in detail all the reasons why you would or would not consider this opportunity, based on what you can see in the figure.