GE254 Geomorphology: The Final Examination

Please respond to #1 and ONLY four of the following question sets. Ask for assistance if you have trouble envisioning any of the Google Earth imagery!

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 40 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 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.
Please respond to Question Set #1 and only FOUR of the following sets.
Each Question Set is worth 40 points total.

1. A map scale of 1:24,000 means 1” on the map = how many feet on the ground in real life? __________

   At the same scale, 1 centimeter on the map = how many meters on the ground in real life? __________

If you are sketching a topographic profile, and your horizontal scale is 1”=500 feet, and your vertical scale is 1”=125 feet, what is your vertical exaggeration? ________________

A typical international map scale is 1:50,000. Is this a larger or smaller scale than 1:62,500? ________

What does a brown stipple pattern (as shown below) signify on a topographic map?

What are two ways you can figure out the surface elevation of a lake or pond on a topographic map?

1. ____________________________________________________________________________________

2. ____________________________________________________________________________________

What does solid green signify on a topographic map? ____________________________________________________________________

2. Compare and contrast thoroughly the origins of the Great Lakes and of landforms of northern Wisconsin, as discussed in the class presentations of Merrill Read and Olivia Amber. How does Cam’s “Driftless Area” of Wisconsin fit into that picture? Relate their discussion of this region to the landscape you see in the image below, which is from south-central Ontario in Canada, just north of Lake Superior. (40 points)
3. 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? Relate these to the features shown in the figure below, from central Florida. (40 points)

![Figure showing karst features in central Florida](image_url)

4. Discuss thoroughly the processes that are clearly active in the segment of the coastline shown in the oblique Google Earth image below, including how each of the major coastally influenced features of the landscape came into existence. Is this predominantly an erosional or depositional coastline? Would you want the home that shows on the cul-de-sac drive on the far right, directly above the "G" of Google? Why or why not? (40 points)

![Coastline image](image_url)
5. The image below is from the Sierra Nevada of California, and shows an area that is ~3650 meters (12,200 feet) above sea level. What is the geologic origin of the two lakes shown? What are the bulbous landforms above and to the left of the lake on the left? What are the planar (flat-surfaced) sloping sheets of debris above and to the right of the right-hand lake, and how did they most likely come into existence? (40 points)

6. What are shown in this oblique Google Earth image from the western margin of Death Valley in California? How did these features form in this clearly desert environment? Why are some parts of the land surface darker than others, and what is this called? What kind of drainage pattern is shown on the land surface here? (40 points)
7. Identify three major landforms that are created by tectonic forces acting on the Earth’s surface, rather than by the resistance of the underlying geologic structure and lithology to erosional forces. What are the forces acting to create each of these three landforms? Why does the chemistry and temperature of a magma matter in the creation of volcanic features, and what are two different specific landforms (i.e., just “a volcano” is insufficient) created by volcanic processes? What was the influence of tectonics on the development of the Aguas and Feos drainage systems in Spain, as discussed in the paper by Harvey and Wells?

8. What size material is most commonly moved by winds, and what determines what will become loess and what will become dunes? What wind regime, or environment, will produce transverse dunes, parabolic dunes, barchans, longitudinal, or star dunes? What did Brookes discover about changing wind patterns in the Western Desert of Egypt from his study of modern and relict dune patterns there? Why are yardangs not dunes, even though they are formed by wind?

9. 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?

10. What are stream capacity and stream competence, and what are the controlling factors on each? What are the two most important factors in determining stream velocity? What determines the turbulence of stream flow, and why is this important? Discuss why the major rapids in the Colorado River are to be found immediately downstream from the confluence with major canyon tributary streams. What happened to the William River in northern Alberta, as it flowed from a till and bedrock terrane through an area of extensive sand dunes, as discussed in the paper by Smith and Smith?

11. Discuss the major points of three of the following in-class presentations (other than your own!):
(a) Geology and Geomorphology of the White Mountains of New Hampshire (PJ Benson)
(b) Geology and Geomorphology of the Green Mountains of Vermont (Kate Kerin)
(c) Geomorphology and Geologic Origin of Squam Lake, New Hampshire (Erica Lehner)
(d) Fluvial Geomorphology of the Yellow River of China (Ruofei Jia)
(e) Geomorphic Processes of San Francisco Bay (Alyssa Lang)
(f) Geology and Geomorphology of New York City (Hugh Doherty)
(g) Fluvial Features of Mars (Nam Le)
(h) Geology and Geomorphology of Venus (Lauren McCarthy)
(i) Geomorphic Impacts of the El Niño-Southern Oscillation (ENSO) phenomenon (Kathy Lipshultz)
(j) Geology and Geomorphology of Altamont, New York (Nick Pattison)
(k) Geologic Origin and Geomorphology of Long Island Sound (Shaw Speer)
(l) Geologic Origins and Geomorphology of Death Valley, California (Thea Weiss)