

- **EPSS C113/C213: Biological and Environmental Geochemistry**

### **Practice Final Exam**

This is a shortened approximation of our final exam. In the real exam, you will have a total of two hours and forty-five minutes. This practice is roughly one third as long. Once Part One (closed book) is completed, you will turn it in to get the 2<sup>nd</sup> part (open book).

You may use as much of the total time on each part as you wish.

Part one is closed book (you only need a pencil/pen), and is worth 1/3 of the total points.

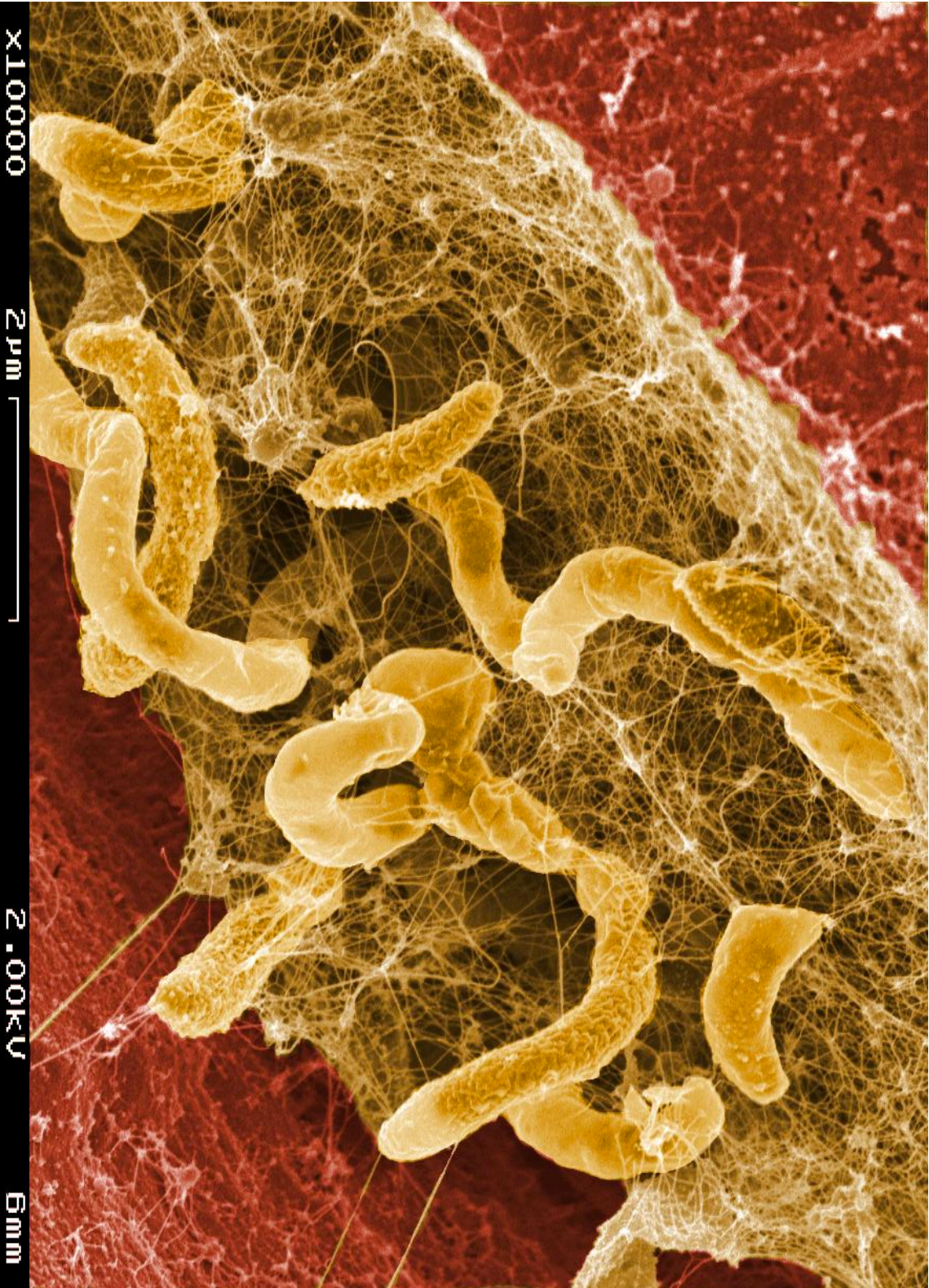
Part two is open book/open note (textbook, notes and handouts are ok, but please do not use the internet, email, or any other communication device for any purpose other than as a calculator or textbook & note reader). It is worth 2/3 of the total points.

Sketches and diagrams are encouraged. Remember to label axes and include scale bars where appropriate!

NAME: \_\_\_\_\_

**Part 1 (2 pages): Closed book – Please complete and set aside before starting part 2.**

1. Aside from the availability of the nutrients N, P and K, what are the two main factors controlling the rate of photosynthesis in land plants? 2 pts.
2. Write a simple chemical equation for a form of respiration that doesn't involve O<sub>2</sub>.  
1 pt.
3. Which of the following ions do you expect to be strongly leached during weathering/soil formation, such as occurred in the Belbex basalts (circle all that apply)(3 pt):  
K<sup>+</sup>  
Ca<sup>2+</sup>  
Fe<sup>3+</sup>  
Zr<sup>4+</sup>
4. Briefly describe the atmospheric greenhouse effect. What determines whether a particular molecule is a greenhouse gas? How does a typical greenhouse gas (e.g., CO<sub>2</sub>) make the Earth's atmosphere warm up? 3pts.
5. What does the Redfield ratio describe? (2pts) 1 extra credit point for writing the correct ratio.
6. Briefly compare and contrast time scales of mixing in the troposphere, stratosphere, and ocean. What processes control the mixing and/or density stratification in each reservoir (3 pts)?



NAME: \_\_\_\_\_

**Part II (3 pages): Answer 2 of the following questions (not all of them!). Open notes/open book. Diagrams/sketches/graphs are encouraged, make sure to show equations and algebra when appropriate. 10 pts/question. If more than two are answered, the scores from the first two graded will be used.**

1. Discuss ways that silicate weathering, photosynthesis, atmospheric CO<sub>2</sub> and carbonate deposition in the ocean are related to each other. Describe a possible long-timescale negative feedback between atmospheric CO<sub>2</sub> abundance and weathering.

2. Compare and contrast the potential for long-term sequestration of organic carbon in sediments (or soils) under forests, wetlands, and the ocean. What controls how much organic carbon reaches the sediment/soil? What affects the persistence of the organic carbon once it's reached the sediment or soil?

3. It is observed that the  $\delta^{13}\text{C}$  of limestones ( $\text{CaCO}_3$  deposits in the crust) varies inversely with the  $\delta^{34}\text{S}$  of sulfate minerals on geological ( $> 10$  Myr) time scales. Why might this occur? Do you expect a strong inverse correlation at shorter time scales? Why or why not?