

You have exactly 20 minutes to complete this quiz. ***Please read each question carefully and show all your work.*** *This is an open book, open notes quiz.* **There are only 4 questions on this quiz. REMEMBER THE CU HONOR CODE. WHEN YOU ANSWER A QUESTION, DON'T WASTE YOUR TIME AND MY TIME REPEATING IT IN YOUR WRITING. JUST ANSWER THE QUESTION.**

1. (1.50 pts) The rule of **components** and **intrusive relationships** states that igneous intrusions are always **YOUNGER** than the sedimentary strata they invade. **Draw a simple cartoon of a cross-section on the back of this sheet of a REAL geologic relationship of this type and provide a SHORT (2 sentence) commentary on the geologic processes involved in your sketch.**
2. (2 pts) Using an instrument call a “mass spectrometer”, you find that the $^{206}\text{Pb}/^{238}\text{U}$ ratio in Chlor-apatite (a basic Ca-phosphate mineral that substitutes chlorine into the lattice) separated from a meteorite (ALH84001) sample collected in Antarctica is found to be ≈ 0.9999 . **Approximately how old is the sample? (*you must show your work*).** **To answer this question, you need to know the D/N ratio, and to look up in your notes & textbook what the half-life is of this particular system.**

[YOU MUST USE THE BACK OF THIS SHEET TO SHOW YOUR WORK]

3. (1 pt) (Short answer, two sentences) EXPLAIN why **unstable** isotopes such as ^{14}C and ^{176}Lu are **suitable** for radioactive dating of rocks and minerals?

Because both of these UNSTABLE isotopes have D/N ratios.

4. (0.50 pts) When you piece together the complete stratigraphy from separate (but related) sequences in a terrane, as we did with our Grand Canyon example in lecture, you are creating “Composite stratigraphic sequences.” **What geologic principles are used to best establish such composite stratigraphic sequences?**
 - A. The principles of superposition and uniformitarianism.
 - B. The principles of lateral continuity and fossil succession.**
 - C. The principles of folding and uniformitarianism.
 - D. The principles of components and discontinuity.
 - E. The principles of angular unconformity and original fossil assemblage.

1. Geologic sketch and commentary.

ANY APPROPRIATE GEOLOGICAL CROSS SECTION THAT INCORPORATES THE PRINCIPLE OF COMPONENTS AND INTRUSION INTO SEDIMENTARY STRATA WAS ACCEPTABLE.

BE CREATIVE! I accepted almost any kind of intrusive relationship that showed also the PRINCIPLE OF COMPONENTS.

2. Radioactive dating problem.

You are provided the D/N ratio, I told you it was 0.99999. Now this is just about equal to 1. In order to arrive at this ratio, you need to go through 1 half life. According to your book, it is 4.6 billion years (but in your notes I told you it was 4.4 billion years). Either way, the age of the mineral equals the number of half lives times the length of the half life. In this case, 1 x 4.4 billion years, or 4.4 billion years old. (4.6 is also acceptable).

IF YOU DON'T UNDERSTAND THIS MATERIAL, YOU MUST COME TO OFFICE HOURS IMMEDIATELY. IT WILL BE ON THE MIDTERM AND THE FINAL EXAM.