Part I. Definitions

Define and/or comment on the significance of all of the following fourteen (14) ideas, concepts, or things in the context of this course. Allow about 25 minutes for this section. (15 questions, 3 points each; 45 points total).

1. $\partial$ notation

2. $^{226}$radium

3. decay constant

4. half life

5. Hardwater Effect

6. Huascaran

7. Pee Dee Bee (PDB)

8. gyttja

9. supported $^{210}$Pb
Part II. Short Essays (55 points)
1. In the Geology paper by Seltzer et al. (2000), the authors note that the $\delta^{13}$C of organic matter and the $\delta^{18}$O of calcite (marl) track one another very closely. What does the covariance of $\delta^{13}$C and $\delta^{18}$O tell you about the lake? Explain fully (10 points).
2. Examine the attached Figure, which shows downcore plots. Please provide a *unifying* explanation for the variations observed in EACH OF THE FOLLOWING: \(\delta^{18}O\), \(\delta^{13}C\), % biogenic silica, % K, and Fe:Mn (20 points).

- \(\delta^{18}O\)

- \(\delta^{13}C\)

- % biogenic silica

- % total K

- Fe: Mn

3. Also for the attached figure, explain the downcore discrepancy in radiocarbon dates from shells and terrestrial macrofossils (5 points).
4. How and why does the radiocarbon time scale differ from the calendar year time scale, and how can the two be equated? (10 points)?

5. In the paper by Bierman et al., the authors state that their Fig. 7 (below) demonstrates that the low LOI intervals (I-V) are caused by sudden storms that spawn severe landscape erosion. Provide an alternative interpretation of the record of LOI and $\delta^{13}C$ that does not involve landscape erosion (10 points).