Geology 41: Environmental and Solid Earth Geophysics
Study Questions: Quiz #2

The following questions are intended to help you study for the second quiz. The questions relate to material covered between February 23 and March 9.

The second quiz will be ready at 11 AM on Monday March 23 and may be taken any time between 9 AM and 4 PM, Mon to Fri that week. The exam must be taken either in ESMNH 311 or Geology Reading Room.

The exam will be closed book/closed notes- HOWEVER, you may bring one page (single-sided handwritten) of notes with you to the exam.

1) What is the *thermal time constant* for conductive heat transfer? For convective heat transfer? How is this used as a rule of thumb to determine the approximate time and/or distance scales for conduction? Convection?

2) Temperature tends to increase with depth in the earth. How does the near-surface thermal gradient relate to surface heat flow? Can there be changes in the thermal gradient without changes in heat flow? If so how, if not why not?

3) Surface heat flow has been used as a proxy for recent changes in climate. How does the near-surface thermal gradient reflect recent changes in climate? Approximately how deep beneath the surface would you expect to see the effects of modern (post-1900) climate change? Holocene (10 ka) climate change?

4) How do each of the following affect surface heat flow (if at all)?
   a) thermal conductivity
   b) geothermal gradient
   c) subduction
   d) erosion
   e) radioactive decay
   f) magma crystallization
   g) clay dehydration

6) Are there differences in magnitude of heat flow between the continents and the oceans? If so, does the mechanisms of heat generation differ between these two environments? How? How is heat flow measured in each of these two environments?

7) What are the Rayleigh and Peclet numbers? How to they relate to convection. If Pe = 12 and Ra=900, what does that imply about heat transfer?

8) What are the sources of naturally occurring electrical potentials and electrical currents in the earth?

7) What electrical properties of rock (or other earth material) can be remotely measured? In practice (i.e., in the real world) what controls these properties?

9) Two different types of resistivity (Wenner) surveys are commonly run. The first keeps the electrode spacing fixed and moves across a study area. The second (VES) keeps the center point of the electrode array fixed, starts with a small electrode spacing and systematically increases the spacing. Do the two types of resistivity surveys give you the same type of information about the subsurface? If not, how does the information obtained by the two types of survey differ?

10) Both types of Wenner surveys measure "apparent resistivity". How (if at all) does that compare with the resistivity of earth materials that can be measured in the lab?

11) What is SP? What electrical phenomena or properties control SP? How do these electrical properties relate to lithological variations?