GEOL 4811
Review for Exam 4

1. We discussed several different electrical methods in this course: VES, CST, ERT or electrical imaging (pseudosection), SP, and Time-Domain, Frequency-Domain and Spectral IP. For each of the following cases, which method would be the best to use, and explain why you would use that particular method:
   a) Determining the location of a massive sulphide deposit;
   b) Determining the depth to bedrock;
   c) Looking for evidence of organic contaminants in soils;
   d) Locating steeply dipping faults in rocks layers beneath a thin soil layer;
   e) Determining the location of a disseminated metal deposit; and
   f) Determining the approximate volume of a landfill in an area.
2. Define resistivity. What is its relationship to conductivity? To Ohm's Law?
3. Draw the arrangement of electrodes for a) Wenner, b) Schlumberger, and c) Dipole-Dipole arrangements.
4. What is a geometric factor? Why is it necessary?
5. Draw current flow lines and equipotential lines for a Wenner electrode arrangement.
6. What happens to current penetration when current electrodes are farther apart?
7. Which electrode array has the best vertical resolution? The best horizontal resolution?
8. Which electrode array is best for vertical electrical sounding (VES)?
9. Which electrode array is best for constant separation traversing (CST)?
10. Which electrode array is best for electrical imaging or electrical resistance tomography (ERT)?
11. What is a pseudo section? How is it used in the interpretation of resistivity and IP data?
12. During a Wenner resistivity survey, a value of 0.195 volts was obtained using an a-spacing of 10 meters and a current of 0.060 amps. What would be the measured apparent resistivity?
13. Describe the Mise-a'-la-masse method.
14. Describe membrane polarization.
15. Describe grain polarization.
16. What is overvoltage? Illustrate it below.
17. During an IP survey, values for resistivity at a location are determined as R_{low} = 50 ohm-m and R_{high} = 40 ohm-m. What would the frequency effect and metal factor be for this point?
18. Describe the three sources of SP anomalies.
19. How are SP surveys conducted?
20. Describe the differences between the Time- and Frequency-Domain IP methods.
21. What is spectral IP? What makes it different and perhaps more useful than more traditional time and frequency domain IP methods?
22. What is an electromagnetic wave?
23. Describe the differences between the following systems with respect to transmitters, receivers, how measurements are made, and how the data are interpreted: a) Small Loop EM, b) Large Loop EM; c) VLF; d) MT; and e) TEM.
24. What is the primary physical property that EM systems explore?
25. How does EM induction work?
26. What are primary and secondary fields in EM exploration?
27. Be able to some of the primary uses of each type of electromagnetic surveying method.
28. How do GPR systems work? What physical properties are important in producing a GPR reflection from the subsurface?
29. What are some applications of GPR data?
30. What factors go into the vertical and horizontal resolution of a GPR survey?

31. What factors deplete radar wave energy in a GPR survey?
32. What are some modes of deployment for GPR?
33. What are some of the processing steps for GPR data?
34. How are GPR data interpreted?
35. How is radioactivity useful in geology/geophysics?
36. Describe in general the process for determining the age of a rock or mineral.
37. What major assumptions are made in radiometric dating?
38. A) What is the decay constant for a radioactive isotope with a half-life of 82 million years? B) If the daughter/parent ratio for the same isotope is 3.5, how old would the sample be?
39. How does a mass spectrometer work?
40. Explain why the percent error increases greatly for K-Ar dating as younger rocks are dated.
41. How is the Ar-Ar method different from the K-Ar method? Under what circumstances does it give better results?
42. How do we know the age of the Earth and the solar system?
43. What is “closure temperature”? Why is it important in radiometric dating?
44. Be able to describe the utility for each of the dating methods listed on pp.256-257.
45. What is measured during a radioactivity survey? How are surveys conducted?
46. What are some of the uses of radioactivity survey data?
47. What is the difference between temperature and heat?
48. Describe two major ways that heat flows in the Earth.
49. What is the geothermal gradient?
50. What s heat flow? What units does it use? What is heat flux? How is it different from heat flow?
51. Describe how heat flux is measured.
52. Be able to draw pictures showing temperature changes with depth and heat flux with depth in a) oceanic and b) continental lithosphere.
53. Describe the general relationship between heat flux and the age of the continental lithosphere.
54. Describe what happens to the temperature profile through time in a) a sedimentary basin and b) after overthrusting.
55. Be able to sketch a picture showing the zones around a well, including the mud cake, invaded or flushed zone, partial invaded zone and undisturbed zone.
56. What are the major types of well logs? What primary physical properties are they measuring in the bore hole? Be able to describe each one.
57. Which type of well log would be the best at determining the true resistivity of a formation?
58. What is the formation factor? How is it related to the determination of porosity?
59. What is the Archie equation? Why is it important?
60. What three different physical properties measured in well logs can be used to determine the porosity of a formation?
61. What is the difference between a normal, lateral and laterolog? Which would be best for identifying narrow sandstone units, and why?
62. Be able to interpret a suite of well longs to identify a porous sandstone unit.
63. Do questions 3 and 7 on pp.311-312.