

GEOL-412 Assignment 1

Please answer the following questions as succinctly as you can. Some answers may be based on material presented in class, available on the course website or in the text. Others may require a little research. Full-sentence answers are not required. I don't mind if you work on these in groups, as long as your answers are in your own words. Please reference any sources of information that you use. The total number of points is 30, and this assignment counts for 10% of the final mark. Completed assignments are due by October 8th.

- 1) The earth's current tilt is 23.5°. What would be the general climatic effect of a much larger tilt—say 33°? What would be the effect of a tilt near to 0°? (2 points)
- 2) On a sunny day an exposed body of rock (such as granite) will get much warmer than the water in a nearby lake. Explain why this is the case. (3 points)
- 3) Explain why the water of the Gulf Stream sinks to form NADW in the north Atlantic, and what factor(s) could change this phenomenon. (3 points)
- 4) Explain why the sun's luminescence has been increasing over its lifetime. (3 points)
- 5) Virtually no sunspots were observed during the Maunder Minimum, which lasted for about 70 years between 1645 and 1715. What is believed to have been impact of this phenomenon on the climate of the period? (5 points)
- 6) The current total mass of CH₄ in the atmosphere is approximately 6500 Tg, and the annual inputs of CH₄ into the atmosphere are as follows (data from R. Herwig, U. of Washington):

Source	Tg/y
wetlands	225
termites	20
ocean	15
methane hydrates	10
rice agriculture	100
other agriculture	115
fossil fuel use	110
biomass burning	40
landfills	40
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Based on this information, what are the relative roles of natural versus anthropogenic sources of methane into the atmosphere? Assuming that the rate of loss of methane from the atmosphere is close to being the same as the rate of input, what is the approximate residence time of methane in the atmosphere? (4 points)

Please answer one of the following two questions. If you chose to do both I will give you up to 5 bonus points for the second one.

7) "Natural gas" can be represented by CH_4 (methane) and "gasoline" can be represented by C_8H_{18} (octane). Write the chemical formulas for the combustion of methane and octane. Natural gas produces energy at a rate of 851 kJ/mol while gasoline produces 4913 kJ/mol. Estimate the ratio of CO_2 emitted per kJ of energy produced for natural gas versus gasoline. (10 points)

8) Use Excel to do a fourier transform time series analysis of the El Niño dataset available at the following location: <http://web.viu.ca/earle/geol-412/assignments/q1-8.htm> (That website also has instructions for using Excel to do a fourier transformation.) Present your results as a graph along with a short explanation. (10 points)
