TOP TEN THINGS TO STUDY FOR TEST #1 - 2013

Test Date: THURSDAY SEPT 19th. *Test #1 will consist of 10-13 multiple choice questions. Some questions will be slight variations of the Self Test or RQ questions, but other questions will be a bit harder than those in the RQ's and they will cover the material in class presentations and assignments, in addition to the reading you've been doing for the RQ's.*

TOPICS COVERED ON THE TEST:

TOPICS # 1 through #6 and the corresponding material in CLASS NOTES, i.e., essentially all material covered in class (including Dr H's presentations and any class activities) since the beginning of the semester. If you missed any classes, see the class follow-up that is linked in D2L and on the external course webpage: http://www.ltrr.arizona.edu/kkh/natsgc/

CLASS ACTIVITIES: The material covered in the ungraded class activity on **Science Quotes & Cartoons** (see Aug 22 Class Follow Up**)**, the class activity on **Plotting Change over Time** (Class Notes pp 15-16) and the ungraded **Periodic Table Background Activit**y (Class Notes pp 107-111) which was discussed in class on Aug 31st.

ASSIGNMENTS: Linking-to-Life Part A - Your Ecological Footprint

SELF TESTS & READINESS QUIZZES: All the questions (and the feedback for both right and wrong answers) in the Self Tests and Readiness Quizzes for the: **Practice ST & RQ on the Syllabus & Course Policies, the Practice ST & RQ- on SGC-I Chapter 1 on Global Change, ST/ RQ-1 on Matter & Energy and ST/ RQ-2 on the Electromagnetic Spectrum and Radiation Laws.**

TEXTBOOK READING & CLASS NOTES pages: All the reading and notes since the beginning of the semester relating to these topics:

Topic #1 Global Change: The Science & the Issues (see p 7 in Class Notes for an overview)
Topic #2 Science and Being a Scientist, including the Pirsig Essay (linked in the Checklist for Week 1 of class.).
Topic #3 Quantifying Global Change - Scales, Rates & Time Series including background on scientific notation on p 14 in Class Notes), the video on **The Powers of Ten** & the class activity on **Plotting Change over Time** pp 15-16 in Class Notes)
Topic #4 Matter & Energy Overview and the Periodic Table Background Activity in Appendix II of Class Notes (pp 111-115)
Topic #5 Electromagnetic Radiation & The Electromagnetic Spectrum
Topic # 6 The Radiation Laws (#1- #4 only) These laws are introduced in the textbook reading you did to prepare for Self Test /RQ-2, including SGC E-Text pp 36-44. They are covered in lecture on Sep 12h & 17th.

And now, here are . . . THE TOP TEN!

1. Understand the things we've discussed about **SCIENCE** in general and how it operates -- and read through the Topic #2 material in CLASS NOTES that builds on what we did in class. *Specific Hint:* Be able to answer questions like those in the class activity on quotes and cartoons. (you can review it under Class Follow Up for Aug 29th.) Also be familiar with the uniqueness of **GLOBAL CHANGE SCIENCE** (i.e. we can't do lab experiments on the whole earth).

2. Be sure you understand that there is a **huge RANGE OF SPATIAL AND TEMPORAL SCALES** to be addressed when quantifying GLOBAL CHANGE. Know how to use scientific notation to express numbers that are very large and very small (see review on p 14 of Class Notes). *Specific Hint:* To gain some familiarity looking at lots of things in nature described with **SCIENTIFIC NOTATION** see how it is used to describe the features shown in the **POWERS OF 10 video** on p 14 in Class Notes. Now flip to pp 27 and 28 and see how the huge range of wavelengths in the Electromagnetic Spectrum are described using scientific notation.

3. Be able to recognize and/or select the proper terminology to describe different types of **"change over time"** in **TIME SERIES GRAPHS**. *Specific Hints.*: Know what the **KEELING CURVE** is and why it is such an important, "iconic" time series graph for Global Change (remember **350.org**?) Review pp 15-17 in Class Notes, including the terms defined in the box on p 15. Could you apply some of these terms to describe the changes in mean global temperature seen in the **graphs on p 17 in Class Notes**?

4. MATTER. Understand the basic concepts relating to **MATTER, ATOMS & MOLECULES** including the structure of atoms, i.e. made up of different particles (proton, neutron, nucleus, electron, etc.), and different views or models of the atom. *Specific Hints:* Be able to answer questions about a "dot diagram" like the one on p. 19 in Class Notes or be able to arrange atoms represented as dot diagrams in proper formation in the Periodic Table (as in the Appendix discussed in Class on Sept 5tht –see pp 111-115 in Class Notes). Do you understand how the Periodic Table is organized? Also know the **difference between matter vs. energy, proton vs. photon**!

5. ENERGY. Understand the difference between the two main forms of energy: **kinetic energy** (KE) & **potential energy** (PE) (see Class Notes p 23-24). *Specific Hints:* What kind of energy is *Electromagnetic Energy* -- kinetic or potential? . Know what the **LAW OF CONSERVATION OF ENERGY** states and how it relates **to Energy Efficiency**. (see p 24 in Class Notes).

6. **MATTER & ENERGY RELATING.** Be familiar with the **quantum behavior of electrons** within atoms (pp 21 and 25-26 in Class Notes) and how **molecules also exhibit quantum behavior** (vibration, rotation, etc.) (discussed in class on Sep 10th and 12th). *Specific Hint:* Know, what a **PHOTON** is and what happens when photons of electromagnetic energy are **absorbed or emitted** by electrons in atoms or by molecules. Do you understand the differences in the way **matter and energy interact** in **Visible Light /Ultraviolet radiation vs. Infrared radiation** (i.e., QUANTUM BEHAVIOR of electrons within atoms for UV & Visible and of molecules rotating, bending or vibrating for IR)?

7. ELECTROMAGNETIC RADIATION. *Specific Hints:* Know how to express the relationship between **wavelength (λ), wave speed (c),** and **frequency (ν) in both words** ("The shorter the wavelength the greater the energy & the higher the frequency." bottom of p 27 in Class Notes) **and in an equation (**in the SGC E-Text Chapt 3 pp 37-38 and discussed in class on Sept 10th). Know **what generates** (i.e. "the typical source of) **UV, Visible, and IR electromagnetic radiation** (Class Notes p 28 and corresponding reading in **Electromagnetic Spectrum Reading PDF** -- linked in the Checklist for the week of Sep 8th.).

8. ELECTROMAGNETIC SPECTRUM Know how wavelengths and frequencies vary in the different parts of the spectrum . *Specific Hints:* be able to divide a graph of the spectrum into **UV, VISIBLE, AND IR** wavelength regions (i.e., know the **key boundaries** for the VISIBLE LIGHT wavelength band in micrometers as shown in Fig. 3-3, p 38 in SGC- E-text and on pp 27-28 in Class Notes). Know which colors of the visible light spectrum have longer wavelengths and which have shorter; recall R-O-Y-G-B-V

9. RADIATION LAWS #1 and #2 Know what a blackbody is, what the blackbody radiation curve looks like (note: it's also called the **Planck function curve (Law #2)** and what information is represented by the curve (see SGC E-Text Fig 3-7a , p 42). Be able to tie this in with **Radiation Law #1**: **All substances emit**

radiation. *Specific Hint:* Know how a blackbody curve of the Sun differs from that of the Earth (i.e., be able to understand what SGC Fig 3-8 on p 42 is showing – as well as the figure on the bottom of Class Notes p 30 that compares Solar vs Terrestrial radiation.

10. RADIATION LAWS # 3 (Stefan-Boltzmann Law & Law #4: Wien's Law) -- be able to state (or recognize) what these laws mean in simple words if the formula is given and be able to recognize that in the Stefan-Boltzmann Law, E & T are directly (not inversely) related in the Law's formula: $E = \sigma T^4$, while in Wein's Law, wavelength and temperature are inversely related in the Law's formula: $\lambda max = k/T$, (where k is a constant). **Understand what each of these laws tell us about the differences in how the Sun and Earth radiate** *ANSWER:* Stefan-Boltzmann tells us that the Sun, being hotter, radiates much, much more energy than the Earth does, while Wien's law tells us that the Sun, being hotter, radiates a maximum of energy at short (UV & visible) wavelengths and the Earth, being cooler, radiates all of its energy at long (IR) wavelengths.

NOTE: At least one of the questions on the test (taken from the "Top 10" above) will be related to something that was covered in the "**SAVED BY THE SUN" VIDEO** segments shown in class thus far. You can watch the same segments we watched in class at:
http://www.pbs.org/wgbh/nova/tech/saved-by-the-sun.html

Sounds like a lot, but if you've been keeping up with your readings, Self Tests, RQ's and listening attentively in class you should have a good grasp of the material. Now you simply need to review it and reinforce it in your mind and you will be ready!

WHAT WILL NOT BE COVERED ON TEST #1: *Detailed questions on SGC-E-text* ***Chapter 1 on Global Change*** *will NOT be asked -- these topics will be addressed throughout the semester.* ***Radiation Laws #5 & #6 :*** *although these will be addressed in class before Test #1, they will be applied in class the following week, so questions about them will go in Test #2.*