TOP TEN THINGS TO STUDY FOR TEST #2 - 2014

Test Date: Tuesday Oct 7th *Test #2 will consist **of 10 multiple choice questions.** As in Test #1, 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 the group assignments, in addition to the reading you've been doing for the RQ's.*

TOPICS COVERED ON THE TEST:

Topic #5 (Radiation Laws 5 & 6), Topic #6 Atmospheric Structure and Composition , and Topic #7 Laws of Thermodynamics & Motion. –Study the presentations and the corresponding material in CLASS NOTES. If you missed any class**es, see the class follow-up that is posted in D2L and is also linked on the main GC 170A class webpage.**

ASSIGNMENTS: G-1 Group Activity on Understanding Absorption Curves *(p 30-33 in Class Notes)*
G-2 on Energy Efficiency *will not be on Test #2 because groups haven't finished it yet, but you should be able to recognize the Energy Flow Diagram of an incandescent lightbulb (see # 8 below)*

SELF TESTS & READINESS QUIZZES: All the questions (and the feedback for both right and wrong answers) in the Self Tests and Readiness Quizzes: **ST/ RQ-3 on Atmospheric Structure and Composition, ST/ RQ-4 on Thermodynamics.** You should also **go back and review ST/RQ-2 on the Electromagnetic Spectrum because it covered many of the Radiation Laws** – which will be tested in Test #2.

TEXTBOOK READING: In **SGC-E-Text review Chapter 3** (pp 34 -49) and the additional online reading material on Thermodynamics (linked in the Checklist and Self Test for RQ-4**.** *(NOTE: The pages in Dire Predictions will not be covered on this test – we'll be digging into the DP text after the Midterm Exam).*

CLASS NOTES / TOPICS: All the reading and notes relating to the following topics.

-- **Topic #5 - Part II The Radiation Laws -- Laws #5 & #6** pp 291-33 (but also review pp 25-28 to refresh your memory on the other laws and the Electromagnetic Spectrum)
-- **Topic #6 Atmospheric Structure & Chemical Composition** – pp 35-39
-- **Topic #7 Thermodynamics and Energy Transformations** – pp 40-47

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

TOPIC #5 THE RADIATION LAWS (Law #5 and Law #6)

1. **Law #5: Radiation & Distance: the inverse square law** -- be able to state it in simple words and recognize it in a diagram. Understand why this law is important and what its implications are for the Earth's temperature. *Specific Hint:* Know what the**Goldilocks Effect** is and whether or not **a planet's temperature** is due ONLY to the inverse square law (see discussion under*Magnitude of the Greenhouse Effect* in SGC-E-Text pp 43-44.) (Hint -- The Goldilocks Effect of earth's temperature being "just right" is due to MORE factors than just the inverse square law –see the Q1 Clicker Question in Dr H's Topic #5 - Part II presentation.

2. **Law #6: Selective Emission & Absorption** -- be able to state this important Law in simple words and explain what it has to do with wavelengths of energy, the electromagnetic spectrum, and atmospheric gases, and the vertical structure of the atmosphere. Understand why this law is important and what its implications are for how electromagnetic radiation of different wavelengths is transmitted through, or absorbed by, the Earth's atmosphere. *Specific Hints:* Know how to read and interpret an **absorption curve** and how to sketch in hypothetical curves (as on p 30 of Class Notes and Assignment G-1.) or be able to match an absorption curve to the gas it represents (as on p 32 of Class Notes and Assignment G-1). Be able to recognize O_3's absorption curve (curve B on p 32 in Class Notes) and describe what is different about it, when compared to the other greenhouse gases. (*Hint:* one part of the curve involves the **absorption of solar UV radiation** (related to the global change topic of stratospheric ozone depletion) and the other part of the curve involves **absorption of terrestrial IR radiation** (related to the global change topic of the greenhouse effect and global warming).

3. Atmospheric windows -- Know what **"atmospheric windows"** are (as seen in the "Absorption Curve for the Whole Atmosphere" on p 32 of Class Notes) *Specific Hint:* Know what the difference is between the UV/Visible Atmospheric Window and the IR Atmospheric Window -- what kind of electromagnetic radiation is being transmitted through each window without being absorbed?

Also be sure you understand the items on the **Solar vs Terrestrial Radiation Class Concepts Self Test** (p 33 in Class Notes and also in G-1) -- Be sure you understand the answers to this page. (They were covered given in Dr H's lecture on Sept 25th.) *Specific Hint:* Understand the difference between **solar vs. terrestrial (IR) radiation** and what is going on at each of the numbered circles in the **diagram on the botto**m of p 33. Which numbered circle on the diagram represents GH gases absorbing and re-radiating IR back to the Earth's surface? Which numbered circle on the diagram represents GC gases absorbing and re-radiating IR out to space? Which numbered circle on the diagram represents IR being radiated from the Earth's surface and going right out to space through the "IR atmospheric window"?

TOPIC # 6 ATMOSPHERIC STRUCTURE & COMPOSITION

4. Atmospheric Structure-- Know how the atmosphere's **STRUCTURE and TEMPERATURE** vary with altitude, and what the names of the different layers are. *Specific Hint*: **what causes** these variations. (See Fig. 3-9 and 3-11 and pp 46-48 in SGC-E-text. And in Class Notes, see pp 35-37.) Understand what the **figure on p 36 in Class Notes** is illustrating about how solar radiation of different wavelengths gets transferred or absorbed on its way to the Earth's surface.

5. The "Greenhouse Warming Signature"-- Know the layer in which the greenhouse gases (GHGs) are most abundant and have their greatest effect. [NOTE: This is shown in the figure in the middle of p 37 in Class Notes that contrasts what's going on in the different atmospheric layers to Incoming Solar radiation (UV+ VIS + Near IR) vs. outgoing Terrestrial radiation (IR).] Understand how the outgoing IR that gets re-radiated back to the surface (e.g., "trapped") in the troposphere leads to a "Greenhouse Signature" of warming in the Troposphere and cooling in the Stratosphere.

6. Atmospheric Composition -- Start out by going through the 4 Key Concepts on p 39 of Class Notes . Know which **GASES** are the *most abundant* in the atmosphere, which are *greenhouse (GH)* gases and which are *non-greenhouse gases*(non-GH gases N, O_2, + Ar comprise 99.96 % / GH gases H_2O & CO_2 are the next most abundant); see Tables 3-2 and 3-3 in SGC-E-Text and p 39 in Class Notes. Know the definition of a GREENHOUSE GAS: "a gas which can absorb and emit infrared (IR) radiation."

7. Sources & Trends of Greenhouse Gases -- Know that nearly all of the major GH come from both natural and anthropogenic sources and be familiar with some of the these sources (see p 38 in Class Notes). *Specific Hints*: Know which GH gases are human-made only. Know whether time series trends have been observed in the concentration of GH gases (as seen in the Keeling Curve and other GHG graphs that were shown during the Topic #6 lecture presentation, e.g. bottom of p 38 in Class Notes). Whenduring the last century does it appear that the concentration of the GHG's started to really increase? *(see the graphs shown in class to try to pinpoint a year or period of years).*

TOPIC #7 THERMODYNAMICS & ENERGY TRANSFORMATIONS

8. The Two Laws, Specific Heat, & Heat Capacity --- Know what the two Laws of Thermodynamics are and why they are important. *Specific Hint:* Understand how ***energy flow diagrams*** (see p 43 in Class Notes) illustrate the 1st Law (energy can be transformed from one form to another, but is always conserved) and can also be used to illustrate aspects of the 2nd Law (eventually some energy dissipates as thermal energy output (exhaust), which leads to a process being less than 100% efficient).*Specific Hint:* can you properly label or recognize an energy flow diagram of an incandescent light bulb?
ALSO . . . .
Know the difference between **thermal energy**, **heat** and **temperature**; understand the concept of **specific heat** and **heat capacity**, and what a calorie is. *Specific Hints:* Do you understand the answers to Clicker Questions # in the presentation for Topic #7- Part II on Sep 25th? Do you see how these same concepts are related to the graphs and two questions in the "Exploring the Evidence . . ." secton on the bottom of p 41 in Class Notes? Can you answer the two questions on the bottom of p 41?

9. Heat Transfer -- Know and understand the difference between the 3 modes of heat transfer: **convection, conduction, & radiation.** *Specific Hint:* Know in what way -- if at all -- ***matter*** is involved in each one of these forms of heat transfer. (If it helps you on this one, review the Heat Transfer Rap video, linked below).

10. Energy Transformations and Energy Efficiency / Laws of Motion- Understand how to read and interpret **energy flow diagrams** like those on pp 43 -45**.** *Specific Hint:* Can you reason your way through the Self Check questions Q1-Q3 in the middle of p 44? Could you label the pipes properly in a flow diagram like that on the bottom of p 44?
-- If the Laws of Motion are stated for you,could you recognize an application of each? (The Laws are stated on pp 46 of Class Notes) Could you relate the concepts of INERTIA and MOMENTUM to **fuel efficiency** issue?

For fun and to review, watch the Heat Transfer rap again! (See Class Follow up for Sep 30th)