Reading Guide for September 29

from Henson, *Rough Guide to Weather*

Chapter 1: The Ingredients

pp. 9–10. *Welcome to Our Atmosphere*. This names the principal components in the atmosphere, and explains that trace components can have effects out of proportion to their proportions.

pp. 10–11. "*Fiery and Foul*." This describes in more detail the three major components of air.

- What is the proportion of **oxygen** in air?
- What is the typical proportion of water vapor in air?
- What are major sources of **aerosols**?

pp. 11–12. "*How the atmosphere evolved*." Unfortunately, this section starts out with an error. Fortunately, the error does not affect the point of the discussion. The error is that Earth and the Sun did not form "in the billion or so years after the cataclysmic Big Bang." Earth and the Sun had to wait something like eight billion years after the Big Bang to come onto the scene. But, I am sure you will agree it was worth the wait.

Skim the part on page 10 that merely describes how the atmosphere evolved from the creation of the Earth until the industrial age. Focus on the part on page 10, which tells about how humans pollute the air.

- What process causes **ozone** to form at ground level?
- How long does a molecule of **carbon dioxide** stay in the atmosphere?

p. 13. Box "The lighter side of humidity." Read this for a surprising and interesting fact about humidity.

p. 13. *Layers of the atmosphere*. Red this introduction to the structure of the atmosphere once. The following sections will give the details.

pp. 13–15. "*The ground floor*." This describes the layer that concerns us most in this class: the **troposphere**.

Although the text does not discuss it here, pay attention to the figure in the upper left of page 14. This shows the temperature profile of the atmosphere. This temperature profile is directly responsible for the properties that divide the atmosphere into layers.

The key points of this section are:

- the sentence "What keeps the troposphere moving are _____

  _____."
  (complete it from the reading.)
- What is the most important temperature difference that powers the weather?

- What happens to air as it rises or sinks?

pp. 15–16. "*Where the ozone is*." This describes the **stratosphere**. The stratosphere does not directly give us weather here at the surface, but it does have some effects. The increase in temperature provides a "lid" for convectional processes in the troposphere such as thunderstorms and hurricanes, and its **ozone** is also of importance to us.

- Why does temperature increase with altitude in the stratosphere?

- How is ozone created in the stratosphere?

- How have humans influenced stratospheric ozone?

pp. 16–17. "*On the way to outer space*." You can safely skip this section.

pp. 17–18. *The Sun and Earth*. We'll address eclipses more in the Astronomy segment of the class, so you don't need to read this short section.

p. 18. "*The source of it all*." You can read this once quickly. Right now all you need to know is that the Sun is hot and bright. I suspect you knew that already. It then describes the solar wind and other magnetic phenomena. These do not much affect the Earth's weather, but they have other effects on society that are described in the box on p. 19.

pp. 19–20. *Solar energy on Earth*. The main point of this section is that a given area of land near the equator receives a lot more of the Sun's energy that the same area near the poles.

- Why is this?

pp. 20–21. "*A little seasoning*." This gives a brief explanation of how the seasons arise from the Earth's orbital motion around the Sun. More diagrams would help, but we'll take what we can get. We will explore this in more detail in class.

pp. 21–22. "*An oblique and eccentric story*." This reports that some of the features of the Earth's orbit have changed over time.

Be able to define the terms **obliquity**, **eccentricity**, and **precession**.

Since this is a book about weather, the discussion is focused on the fact that these changes have an impact on Earth's climate, though exactly what these impacts are is far from settled. Keep that in mind when we soon begin to study meteorology. For now, the important thing is that the orbital parameters change.

from Gribbin and Gribbin, *From Here to Infinity*

Chapter 1. Earth

pp. 25–27. *Calendrical Conundrums*. What is a "**day**," exactly? Find out on p. 25.

- How are **solar** and **sidereal** days defined?

- Which day is longer: solar or sidereal? Why?

Then, on p. 27, we learn about another unit of time based on an astronomical event: the **year**.

- How long is a year?

- What is the purpose of **leap years**?

pp. 28–31. *Seasons and Super-Seasons*. This section explains in good detail why weather has seasons, and why the pattern of seasons changes somewhat over very long time periods.

Through the middle of page 30, the text explains how the seasons work now.

- Why do the northern and southern hemispheres alternate between pointing toward and away from the Sun?

- Why is it hotter in summer than in winter?

- Why does sunlight feel hotter at noon than in the morning or evening?

From the middle of page 30 through page 31, the text describes **Milankovitch Cycles**.

- Over time, what properties of the Earth's orbit change?

- What is the direction of the current change in the Earth's seasonality?

- What conditions are thought to be responsible for Earth's recent ice ages?