

Reading Guide for November 10

from Gribbin and Gribbin, *From Here to Infinity*

Chapter 4. The Inner Solar System

pp. 82–84. *Planets and Rocks*. This section gives an overview of the bodies in the Solar system. Read this section once.

Note the amazing fact on p. 83 that all planets orbit the Sun in the same direction and in the same plane, the **ecliptic**. This is an important clue to how the solar system formed.

pp. 84–88. *Mercury*. I am amazed that the ancients knew of the planet Mercury. I have never been able to see it myself.

The length of Mercury’s “day,” that is, the time it takes to rotate once on its axis, has been determined only recently.

- How can Mercury be one of the hottest and one of the coldest places in the Solar System at the same time?
- How do impact craters on Mercury differ from those on the Moon?

pp. 88–94. *Venus*. Venus is Earth’s “twin” in terms of size and composition, but in terms of its potential for life, it is the evil twin.

- What is the average temperature at the surface of Venus?
- What fraction of incoming sunlight reaches Venus’s surface?
- What composition difference prevented Venus’s carbon dioxide from being removed from the atmosphere and incorporated into rocks, as it was on Earth?
- What are two possible reasons for the lack of plate tectonic activity on Venus?
- What dominant geologic process is thought to create the surface of Venus?

pp. 95–98. *Mars*. Although Mars is not much like Earth, it is the most similar to Earth of the other planets in the Solar system. It is thought to be the planet most likely to harbor life, or to have once had life.

- How does the mass of Mars compare to the mass of the Earth?
- How long is a martian day?
- What is the surface temperature range on Mars?

- What are the prominent topographic features of the surface of Mars?

pp. 98–101. *The Asteroid Belt*. This describes a curious collection of fragments (mostly) between the orbits of Mars and Jupiter. Read it through once.

- How does the combined mass of all the asteroids compare to the mass of the Moon?
- About what fraction of the asteroids have Earth-crossing orbits?

pp. 101–104. *Making Rocky Planets*. This section describes our best current idea of how the inner solar system formed. This is the “solar nebula hypothesis,” which accounts for the formation of the Sun, all its planets, and the other odd components of the solar system as well, but the account here concentrates on the origin of the four inner planets and the asteroids.

- What was the initial form of the solid matter in the cloud that formed the solar system?
- Why does the inner solar system now consist of four large planets instead of numerous smaller objects?
- How long after the initial collapse of the cloud did it take for the planets to reach their present sizes?

Chapter 5. The Outer Solar System

pp.108–110. *Gas Giants and Ice Mountains*. This gives an overview of the outer solar system and how it differs from the inner solar system.

- The outer gas giant planets were once thought to have formed by “bottom-up” process. Why is this *not* correct?
- What is the “top down” process by which the gas giants are now thought to have formed?

pp. 110–111. *Making Giant Planets*. This scenario has many details. The key idea is that, when the solar system was about 700 million years old, Jupiter moved into a closer orbit and Neptune moved farther away.

- What objects struck the inner planets in the **Late Heavy Bombardment**?
- Why are there no rocky planets in the outer solar system?

The rest of this rather long chapter describes the objects in the outer solar system.

pp. 111–114. *Jupiter*. Although Jupiter is much smaller than the Sun, it is by far the largest planet in the solar system.

- Why does Jupiter appear so bright in the night sky?

- How does the mass of Jupiter compare to that of the other planets?
- Of what chemical elements is Jupiter principally composed?
- Why does Jupiter have stripes?
- What is the **Great Red Spot**?
- What is the energy source for Jupiter's atmospheric activity?
- What produces Jupiter's strong magnetic field?

pp. 115–118. *The Galilean Moons*. Although Jupiter has many orbiting satellites, these are the very biggest. The innermost Galilean moon is **Io**.

- What distinguishes Io from all other solar system objects?
- What material erupts from Io's volcanoes?

The second closest Galilean moon is **Europa**.

- What material makes up Europa's crust?
- What structural features are on Europa's surface?

The distance scale in Figure 72 on p. 116 is marked in odd units. "1m km" means "1 million kilometers", etc.

Ganymede is the third Galilean moon.

- What sets Ganymede apart from all other moon in the solar system?
- What material makes up Ganymede's surface?

The outermost Galilean moon is **Callisto**.

- What is unique about Callisto's composition?
- How is Callisto's unique structure thought to have arisen?
- What is the most prominent feature on Callisto's surface?
- Which of Jupiter's Galilean moons are geologically active?

pp.118–121. *Saturn*.

- What is Saturn's most striking visual feature?
- What is Saturn made of?

pp. 121–124. *Rings and moons*. Although all of the gas giant planets have rings and moons, Saturn has some of the most noteworthy.

- What is the structure of Saturn's rings?
- What are the rings made of?
- How thick are Saturn's rings?
- What is notable about Saturn's moon **Titan**?
- Why do we know so much about Titan compared to other distant moons in the solar system?
- What are the most prominent features on Titan's surface?

pp. 124–126. *Uranus*.

- How was Uranus discovered?
- What is unusual about Uranus's axis of rotation?
- What color is the surface of Uranus?

pp. 126–218. *Neptune*.

- How was Neptune discovered?
- What two things are unusual about the orbit of Neptune's moon **Triton**?

pp. 128–129. *The Kuiper Belt*.

- What objects make up the Kuiper Belt?
- What materials compose the Kuiper Belt objects?
- Why is **Pluto** no longer regarded as a planet?

- What relationship may Neptune's moon Triton have to the Kuiper Belt?

The orbit for Eris drawn in Fig. 80 cannot be correct. It violates the Kepler's laws by not having the Sun at one focus of its elliptical path.

p, 130–133. *A Cloud of Comets*. This section describes the **Oort Cloud**, which has never been directly observed. However, something out there must be the source of the **long-period comets**.

- Why is the Oort Cloud thought to be spherical rather than disk-shaped?
- Approximately how many comets are thought to occupy the Oort Cloud?