Hewitt/Lyons/Suchocki/Yeh

Conceptual Integrated Science

Chapter 28

THE SOLAR SYSTEM

Overview of the Solar System

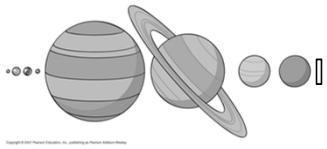
The Solar System consists of:

- Sun
- System of planets
- Minor Planets
- Asteroids
- Comets

Overview of the Solar System

Planets are divided into two classes:

- Terrestrial planets: Mercury, Venus, Earth, Mars
- Jovian planets: Jupiter, Saturn, Uranus, Neptune



The Solar Nebula Theory

Theory that the Sun and planets formed together from a cloud of gas and dust - a *nebula*.

The Solar Nebula Theory

- Gravitation between materials in the cloud pulled it inward.
- When pulled inward, spin increased in accord with the conservation of angular momentum.
- The spinning cloud conformed to the shape of a spinning disk.
- The center of the disk is the *protosun.*
- Away from the center, *planetesimals* formed.
- Planetesimals accreted more matter to become planets.

The Sun

- nearest star to Earth
- composed of mostly hydrogen
- hydrogen is converted to helium by thermonuclear fusion in its core
- 4.5 million tons of mass are converted to energy each second
- A tiny fraction of this energy reaches and sustains Earth

The Inner Planets

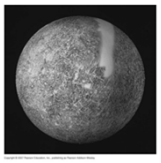
The Inner / Terrestrial planets:

- four nearest to the Sun (Mercury, Venus, Earth, Mars)
- composed of high-density solid rock and metals
- Orbital speeds of planets around the Sun decrease with increasing distance from the Sun

The Inner Planets

Mercury:

- Closest to the Sun
- Slightly larger than our Moon
- Almost no atmosphere due to small size
- Daytime is long and hot (up to 430°C)
- Nighttime is long and cold (about -170°C)



The Inner Planets

Venus:

- Next closest to the Sun
- Diameter about 0.95 that of Earth
- Very dense atmosphere, mostly carbon dioxide
- Very active volcanically
- Very harsh place

The Inner Planets

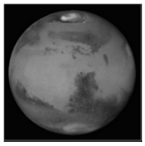
Earth:

- Third planet from the Sun - our home
- At a distance where most of its water is neither solid nor gas, but liquid

The Inner Planets

Mars:

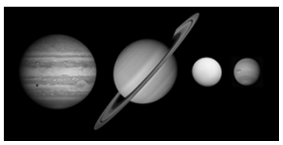
- Fourth planet from the Sun
- Little more than half Earth's size
- Thin atmosphere—95% carbon dioxide and 0.15% oxygen
- Equatorial temperatures range from 30°C in day to –130°C at night
- Presently the focus of planetary exploration



The Outer Planets

Outer / Jovian planets:

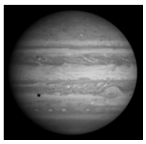
- Gaseous, low-density worlds
- Appreciably larger than Earth
- More widely spaced than the inner planets
- In order of distance from Sun: Jupiter, Saturn, Uranus, Neptune
- Have rings!



The Outer Planets

Jupiter:

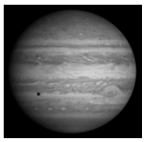
- First of the outer planets, beyond Mars
- More than 11 times Earth's diameter—giant of the solar system
- Composition more liquid than gaseous or solid
- Atmospheric pressure more than a million times that of Earth's



The Outer Planets

Jupiter:

- Atmosphere is 82% hydrogen, 17% helium, 1% methane, ammonia, and other molecules
- No definite surface
- Solid core of iron, nickel, and other minerals



The Outer Planets

Saturn:

- Most remarkable for its easily seen rings
- Twice as far from Earth as Jupiter
- Diameter about ten times that of Earth, excluding the rings
- Lowest density of all planets (density is less than that of water)

The Outer Planets

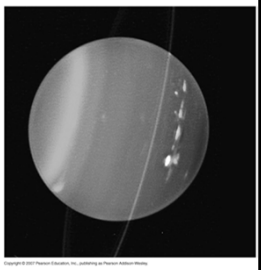
Saturn:

- Surrounded by easily visible rings
- Inner part of rings, like any satellite, travels faster than outer part of the ring system
- Rocks that make up the rings orbit independently of other rocks

The Outer Planets

Uranus:

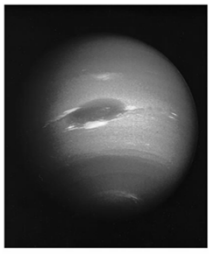
- Twice as far from Earth as Saturn
- Diameter about four times that of Earth
- 98° tilt to the orbital plane
- Faint ring system
- Methane atmosphere
- Very cold place



The Outer Planets

Neptune:

- Lies beyond Uranus
- Diameter almost four times that of Earth, somewhat smaller than Uranus
- Atmosphere mainly hydrogen and helium
- Highly elongated elliptical path about the Sun



The Outer Planets

Pluto – A special case:

- Officially NOT a planet, but a dwarf planet
- Very unlike other planets in composition, size, and orbit
- Highly elliptical orbit, like comets
- Spends most of its orbital time well beyond Neptune, in the Kuiper Belt
- Composition like that of Kuiper-Belt objects
- Look-alike neighbors also dwarf planets
- *Planetary status was more historical than astronomical*

Earth's Moon

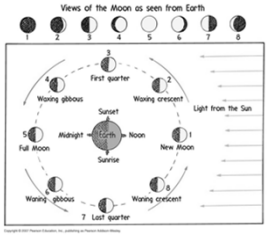
- More is known about the Moon than any other celestial body
- Diameter about one quarter that of Earth
- No atmosphere - no weather and erosion to conceal past scarring of its surface

Earth's Moon

Twelve people have stood on the Moon. Here we see Buzz Aldrin, one of the three Apollo 11 astronauts.

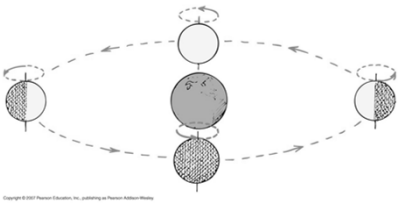
Earth's Moon

Phases of the Moon:

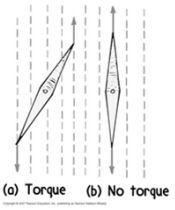


Earth's Moon

The Moon spins about its polar axis as it revolves around Earth.

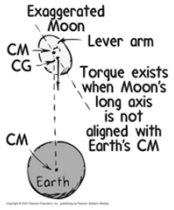


Earth's Moon



A magnetic compass aligns with a magnetic field.

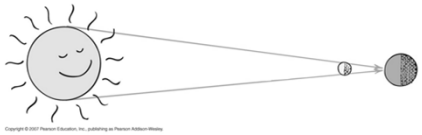
Like a compass in a magnetic field, the Moon aligns with Earth's gravitational field.



Earth's Moon

Eclipses occur when a shadow from one object falls on another.

This is a solar eclipse, as the Moon's shadow falls on Earth's surface.



Earth's Moon

A lunar eclipse occurs when Earth's shadow falls on the Moon.

Asteroids, Comets, and Meteoroids

Asteroids:

- Small rocky bodies that orbit the Sun
- Most are located between Mars and Jupiter
- Some encounter Earth

Asteroids, Comets, and Meteoroids

Comets:

- Differ from asteroids in chemical composition
- Are masses of water, methane, ice and dust
- Most located in Kuiper Belt and in Oort Cloud
- Highly elliptical orbital paths
- Tail of comets swept outward from Sun by solar wind

Asteroids, Comets, and Meteoroids

Meteoroids:

- are relatively small (sand-grain to boulder size) pieces of debris chipped off asteroids or comets.

Meteor:

- a meteoroid that strikes Earth's atmosphere
- Often called a "falling star"

Meteorite:

- is a meteoroid that survives being vaporized in the atmosphere and that reaches Earth's surface.