

# Chapter Outlines

**NOTE: This is intended to help students 'organize' their understanding of each topic. It is not a comprehensive study guide for quizzes or midterms, i.e. study your text!**

## Our Solar System (partial)

### Overview of the Planets

- According to the **Nebula Hypothesis**, our solar system formed from a cloud of interstellar dust and gas approximately 4.5 billion years ago
  - Under its own early gravitational force this cloud began to contract and slowly spin, forming a flattened disk
  - Most of the mass gathered near the center to form the hot protosun (*early sun*)
  - Other bits of debris slowly clumped together forming larger and larger planetesimals until there were eight distinct planets, and leftover debris

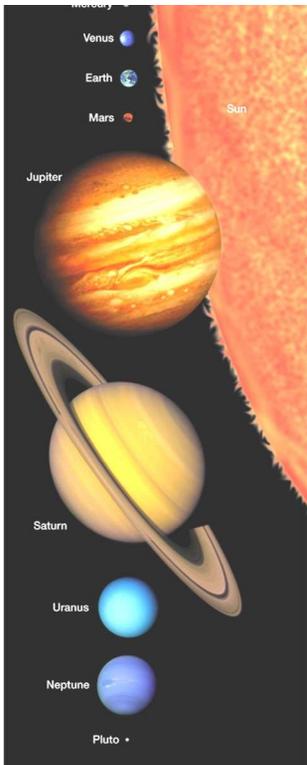
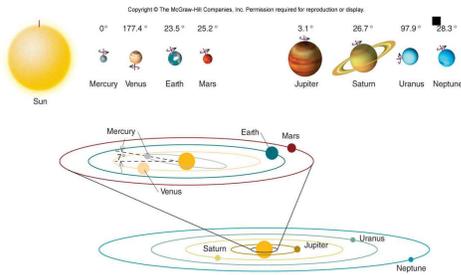
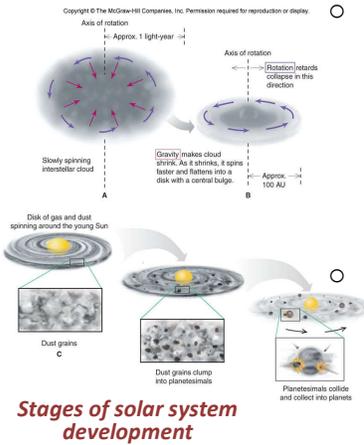
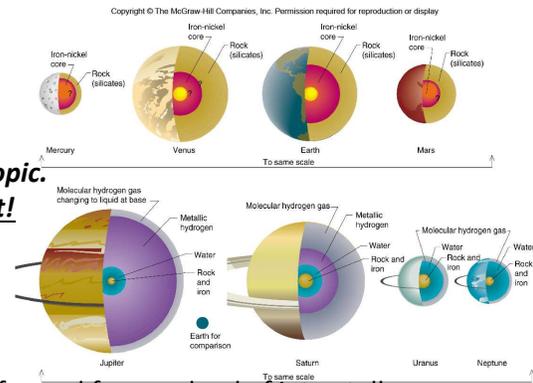
- The planets can be divided into two groups

#### ▪ Terrestrial planets (*Mercury, Venus, Earth, Mars*)

- ◆ The four nearest the Sun
- ◆ All are smaller than outer planets
- ◆ Are rocky and denser than the outer planets (*as high as 5.5 gms/cm<sup>3</sup>*)
- ◆ All have either no atmosphere or meager atmospheres

#### ▪ Jovian planets (*Jupiter, Saturn, Uranus, Neptune*)

- ◆ The four furthest from the Sun
- ◆ Are all much larger, less dense (*as low as 0.9 gms/cm<sup>3</sup>*), and contain large amount of gases
- ◆ All have multiple moons
- ◆ All have thick atmospheres of hydrogen, helium, methane, and ammonia
- ◆ The thicker atmosphere of the Jovian planets is a result of cooler temperature (*distance from the Sun*) and the greater gravity of the Jovian planets



### Tour of the Planets (in order from the Sun)

#### ○ Mercury

- Very hot and difficult to see due to being very close to the Sun
- Mercury has a large iron core, is heavily cratered from its early days, and has essentially no atmosphere



#### ○ Venus

- The hottest planet with temperatures of 480°C in the day (*basalt rock will melt at approximately 1,000°C*)
- We can't see the surface due to permanent thick cloud cover (*mostly carbon dioxide*)
- There appears to be slow convection within the mantle but no plate tectonics...the planet's interior is likely similar to Earth's but is not well understood
- The surface has been mapped by satellites using radar; there appear to be thousands of volcanoes and many old lava flows.





- **Earth** (*discussed in other chapters*)



- **Mars** – 2 moons
  - Mars' surface is normally clearly visible by telescope
  - There is evidence that during the first billion years of Mars history there was flowing water including ancient river beds, erosional features, and sedimentary rock. There is only small amount of frozen water now. Highlands are heavily cratered, lowlands have volcanic features
  - The thin Martian atmosphere is mainly carbon dioxide. Dust storms are common.
  - Mars' early molten iron core is no longer liquid, due to cooling



- **Jupiter** – 63 moons (*'gas giant'*)
  - The largest planet, nearly large enough to have become a second sun
  - Its magnetic field is a result of a liquid iron core
  - Continually covered by clouds and belts of strong winds, which are driven by internal heat. It has a well-known 'Giant Red Spot' which is a non-ending storm.
  - The dense atmosphere is mainly hydrogen and helium, and Jupiter's surface is likely liquid hydrogen
  - Jupiter's many moons have fascinating geologic activity, including the possibility of liquid water beneath a frozen surface



- **Saturn** – 56 moons (*'gas giant'*)
  - Its magnetic field is a result of a liquid iron core
  - It has the most distinctive rings
  - Continually covered by clouds and belts of strong winds, which are driven by internal heat



**Uranus**

- **Uranus** – 27 moons; **Neptune** – 13 moons
  - Their magnetic fields are both a result of a liquid iron cores
  - Continually covered by clouds and belts of strong winds, which are driven by internal heat... known as 'ice giants'
  - Their blue color is due to the methane in their atmospheres



**Neptune**