

REVIEW FOR SECOND EXAM

1. Solar System

- Planet names, order, basic properties (which are Terrestrial, which are Jovians, which is biggest/smallest, etc)
- Know about space exploration, in terms of the lowest energy transfer orbit (Hohmann orbits); know how to use Kepler's third law to find the travel time from one planet to another
- Gases, Pressure, Temperature, Density and the Ideal Gas Law; concept of gas as particles in motion
- Doppler shift - motion toward or away produces wavelength shift
- Planetary astronomy:
 - atmospheric escape/retention - competition between thermal speed and escape speed, dependence on mass of gas particle
 - temperatures of planets - concept of albedo, cooler when farther away
 - relation between density and composition: know rough values for ice, rock, and iron (1000, 3500, and 7900 kg per cubic meter)
 - know about planetary magnetic fields in relation to the dynamo mechanism: circulating conducting fluid

2. Sun

- be familiar with general properties of the Sun
- interior – fusion, p-p chain (conversion of hydrogen into helium), neutrinos, the neutrino problem and resolution, know how long the Sun can live (10^{10} years)
- atmosphere – photosphere, chromosphere, corona, sunspots, solar flares; know that light takes a couple 100,000 years to get from the core to the surface
- the solar cycle – 11 year and 22 year periods, the Babcock model
- solar wind and the concept of mass loss

3. The Earth

- has a dipole magnetic field, nearly lined up with rotation axis
- atmosphere - know about the destruction of the ozone layer, concept of greenhouse effect; know the value of the scale height (8 km)
- interior - know components of core, mantle, and crust
- weather - know about Hadley cells and the Coriolis force mechanism for circulation
- volcanism - as resurfacing
- plate tectonics - know about earthquakes and their use for studying the Earth interior (seismology)

4. The Moon

- phases - know their names, understand the viewing geometry, be able to relate time of day with Moon position in sky and lunar phase
- eclipses - know about solar and lunar eclipses, why and how they occur
- surface - know about mare, terrae, impact basins
- craters - impacts and the idea of relative dating
- interior - iron poor, no magnetic field
- know about the tidal force
- origin - know the major models, their strengths and weaknesses
- colonization of Moon - know about the issues (water, air, lower gravity)

5. Mercury – interior (large iron core), lack of atmosphere, orbital properties, orbital-rotational resonance

6. Venus – thick CO₂ rich atmosphere, strong Greenhouse effect, volcanism and resurfacing, comparisons to Earth, retrograde rotation, very slow rotation, lack of magnetic field

7. Mars – slight magnetic field, thin CO₂ atmosphere, evidence for past water at Mars and for subsurface frozen water ice, evidence for and against past life at Mars (Lowell and “canali”), comparisons of Mars with Earth

8. Comparative Planetology –

- Why do Mars and Venus have CO₂ atmospheres but Earth does not? Where is the CO₂ on Earth?
- Why does Earth have an oxygen-rich atmosphere?

EQUATIONS

- Doppler shift

$$\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$$

- Kepler’s third law relating period P to semi-major axis a

$$P^2 = a^3$$

- The average density ρ for a spherical body of mass M and radius R is given by

$$\rho = \frac{3M}{4\pi R^3}$$

- The surface gravity for such a body is

$$g = \frac{GM}{R^2}$$

- The escape speed from its surface is then

$$v_{\text{esc}} = \sqrt{\frac{2GM}{R}}$$

- The average thermal speed of particles in a gas with temperature T and mass m is

$$v_{\text{th}} = \sqrt{\frac{3kT}{m}}$$

- If heated entirely by sunlight (with the Sun having temperature T_{\odot} and radius R_{\odot}), the expected temperature T_p of a planet with orbital distance d_p and albedo A_p will be

$$T_p = T_{\odot} \sqrt{\frac{R_{\odot}}{2d_p}} \sqrt[4]{1 - A_p}$$