REVIEW FOR EXAM 3: THE SOLAR SYSTEM

MAJOR TOPICS:

I. The Celestial Sphere -- appearance and motions in the sky
- Constellations
- Coordinate Systems (horizon, RA & Dec, etc.)
- Daily motion
- Annual motion of the Sun & Stars
- Motion and phases of the moon

III. Solar System
- The nature of planets & moons
- Details about the Earth
  - Interior, Surface, Oceans, Atmosphere

I. THE CELESTIAL SPHERE (YOU CAN'T FORGET STUFF!)
A. Constellations: FIELD GUIDE Ch. 4
  - Origin and organization, asterisms
  - Constellation names, abbreviations, genitives
    (FG pp. 440-441)
  - Star names ("other" and Bayer designation)
    Know how to find them!
B. Coordinate systems: NIGHTS, Oct. 8-24, FIELD GUIDE Ch. 15
  - horizon - horizon, zenith, nadir, meridian, etc.
  - celestial - RA, Dec, NCP, SCP, Celestial Equator
C. Motions in the sky
  - daily motion CYCLES pp. 1-10
    stars, sun, moon, planets, comets, etc. circle NCP once per day
  - annual motion CYCLES pp. 20-32
    equinoxes and solstices: right ascension, declination, constellation, date
    Review the Celestial Coordinates Lab!
    Review NIGHTS Jan. 19-20, Feb. 25-26, Mar. 6-10, 21, 22, April 2-4, 7, 8,
    the sun's motion along the ecliptic, and in declination (the analemma), the Zodiac
    sidereal and solar day and the analemma
  - motion and phases of the moon CYCLES pp. 11-19
    phases, elongations, times of rising, transit, and setting (MOON WORKSHEET!!)
  - motion and positions of the planets
    planetary longitudes, elongations, times of rising, transit, and setting
    (PLANETS WORKSHEET!!)

Review all the worksheets
All the Calculations!

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Along with budget cuts came a marked reduction in new discoveries.
III. THE SOLAR SYSTEM

- worlds (expect images ... study the power points and your Field Guide Ch. 8 - 14)
  Be able to describe the basic nature (rocky, icy, gas, atmosphere, craters, volcanoes, etc.) of the inner eight planets, the Galilean Moons, Titan, Enceladus, Mimas, Miranda, Triton, and Luna. Also know where to find (as in, the world) the largest impact crater, largest volcano and largest mountain.

- current positions of the planets in the sky (http://www.fourmilab.ch/solar/solar.html)
  understand how to use Appendix 11 and the planetary longitudes to find the positions of the planets (and the sun ... and the moon using the phases listed on FG pp. 350-1) in the sky

- arrangement, size, and formation of the solar system
  Handy Websites: http://www.seds.org/billa/tnp/
  http://stardate.org/resources/ssguide/
  http://www.novaspace.com/

The Astronomical Unit (AU)

\[
1 \text{ AU} = \text{mean Earth-Sun distance} \\
= 150,000,000 \text{ km (150 million km)} \\
= 93,000,000 \text{ mi (≈ 100 million miles is close enough)}
\]

<table>
<thead>
<tr>
<th>NAME</th>
<th>SYMBOL</th>
<th>SIZE</th>
<th>DISTANCE FROM SOL</th>
<th>LENGTH OF DAY</th>
<th>LENGTH OF YEAR</th>
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<td>MERCURY</td>
<td>♀</td>
<td>0.4 R⊕</td>
<td>0.4 AU</td>
<td>60 d⊕</td>
<td>½ y⊕</td>
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<tr>
<td>VENUS</td>
<td>♂</td>
<td>0.95 R⊕</td>
<td>0.7 AU</td>
<td>243 d⊕ (R)</td>
<td>0.6 y⊕</td>
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<tr>
<td>EARTH</td>
<td>☉</td>
<td>1.0 R⊕</td>
<td>1.0 AU</td>
<td>1d⊕</td>
<td>1 y⊕</td>
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<tr>
<td>MARS</td>
<td>♀</td>
<td>0.5 R⊕</td>
<td>1.5 AU</td>
<td>1.03 d⊕</td>
<td>2 y⊕</td>
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<tr>
<td>ASTEROIDS</td>
<td>☿</td>
<td>0.1 R⊕</td>
<td>3 AU</td>
<td>——</td>
<td>5 y⊕</td>
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<tr>
<td>JUPITER</td>
<td>♄</td>
<td>11 R⊕</td>
<td>5 AU</td>
<td>10 h⊕</td>
<td>12 y⊕ (= ONE CONSTELLATION OF THE ZODIAC PER YEAR)</td>
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<tr>
<td>SATURN</td>
<td>♃</td>
<td>9.5 R⊕</td>
<td>10 AU</td>
<td>10.25 h⊕</td>
<td>30 y⊕</td>
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<td>URANUS</td>
<td>♃</td>
<td>4.1 R⊕</td>
<td>20 AU</td>
<td>17 h⊕ (R)</td>
<td>85 y⊕</td>
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<td>NEPTUNE</td>
<td>♜</td>
<td>3.9 R⊕</td>
<td>30 AU</td>
<td>16 h⊕</td>
<td>165 y⊕</td>
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- Earth as a planet
    interior layers: names, composition, phase (solid, liquid, plastic)
    be able to explain the driving force of plate tectonics & source of the magnetic field
  -- surface
    geology:
      cratering (Barringer, Chicxulub, Manicouagan http://www.solarviews.com/eng/tercrate.htm)
      volcanism (http://volcano.oregonstate.edu/)
      types of volcanos: shield, cinder cone, composite & examples of each
      plate tectonics & the motion of the continents
--- oceans: importance of water in the evolution of the atmosphere & life

Major Currents:
1. Trade Winds Create Westward Currents
2. Continents Force Currents N & S
3. Ocean Gyres Created by 1 and 2
   - Eckman Spiral creates force ⊥ to current
   - Water "piles up" in centers of gyres

--- atmosphere

composition
- primarily N₂ (78%), O₂ (21%), Ar (1%), CO₂ (0.037%)
- differs from Mars, Venus (WHY?)

evolution of composition
- oceans absorbed CO₂, locked it into rocks
  - what happened on Mars?
- plant life generated and maintains O₂ composition, evolution, circulation (Hadley Cells)

forces on air
- pressure gradient force (air moves from high to low pressure)
- coriolis force (acts only on moving objects)
global circulation

DRIVEN BY SUNLIGHT HEATING SURFACE AIR AT SUBSOLAR LATITUDE

1. Air rises at ITCZ (Doldrums)
   Rising Air = Low Pressure
   Cools -- moisture condenses -- precipitation
   Spreads north and south aloft and continues cooling

2. Air sinks at about 30° N and S (STHPC) (Horse Latitudes)
   Sinking Air = High Pressure
   Dry since it lost moisture when rising
   Spreads north and south, coriolis deflection creates Trade Winds & Westerlies

3. Air Sinks at Poles (Polar High)
   Moves southward (northward) & deflects right (left) along surface
   Polar Easterlies

4. Convergence Zone at 60° N and S (Polar Front)
   Rising Air = Low Pressure
   Cools -- moisture condenses -- precipitation
   Spreads north and south aloft and continues cooling

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BE ABLE TO RECREATE THIS DIAGRAM WITH NO HINTS!

KNOW HOW THE CONTINENTS FIT!
WHERE ARE THE ITCZ, RAINFORESTS, DESERTS, TRADES, WESTERLIES, AND EASTERLIES?
WHY ARE THEY WHERE THEY ARE?

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Insolation & Energy Budget

Solar constant: amount of energy reaching the top of Earth's atmosphere = 1,370 W/m²
   about 51% reaches ground (~700 W/m²)

Scattering: Blue sky & Daylight
   Light is scattered, blue scattered more strongly than red → blue sky, yellow to red sun
   IR is not scattered ... so IR comes only in sunbeam making sunbeam feel warm

Absorption by atmosphere
   Transparent to visible, some IR, radio
   Absorbs most IR, almost all UV, X-ray

Absorption & Re-radiation by surface (Greenhouse)
   Absorbs shortwave (visible), radiates longwave (IR)