

## 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
- Positions of the planets (sky & orbits)
- Motion and phases of the moon

#### II. Stars

- The nature of light and structure of matter
- The properties of the stars
- Stellar evolution

#### III. Solar System

- Worlds
- Planetary processes
- Earth as a planet

### I. THE CELESTIAL SPHERE (YOU CAN'T FORGET STUFF!)

A. Constellations: FIELD GUIDE Ch. 4

B. Coordinate systems: FIELD GUIDE Ch. 15

- horizon - horizon, zenith, nadir, meridian, etc.
- celestial - RA, Dec, NCP, SCP, Celestial Equator

C. Motions in the sky

- daily & annual motion CYCLES pp. 1-10
- motion and phases of the moon CYCLES pp. 11-19
- motion and positions of the planets  
planetary longitudes, elongations,  
times of rising, transit, and setting  
(**PLANETS WORKSHEET!!**)

Know how to find elongation  
(East and West)

Review all the  
worksheets  
All the Calculations!

### II. STARS

A. The Sun FIELD GUIDE Ch. 14

$$E=mc^2$$

B. Spectroscopy

- The nature of light, inverse square law, electromagnetic spectrum
  - types of spectra and their sources (continuum, emission line, absorption line)
- Spectral Classes: **O B A F G K M**

C. Star Properties (how do we measure or calculate ... any needed equations will be given)

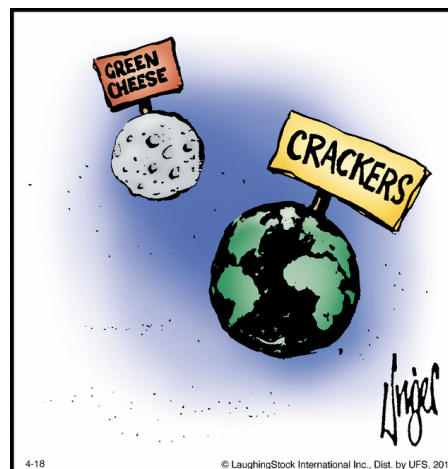
- temperature, distance, size, flux and luminosity

D. HR diagram FIELD GUIDE Appendix 3

E. Stellar evolution FIELD GUIDE Ch. 5 (p. 144-167)

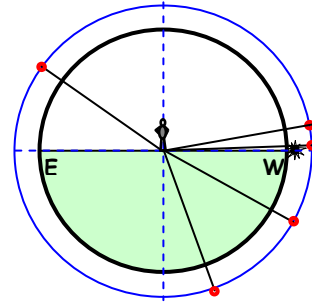
- Star Birth (e.g. Great Nebula in Orion, Eagle Nebula: Pillars of Creation)
- Main Sequence Stars
- Red Giant Stage
- Star Death

Bring your  
Field Guide  
to the exam!



### 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 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://photojournal.jpl.nasa.gov/>  
<http://www.solarviews.com/>



#### The Astronomical Unit (AU)

- 1 AU = mean Earth-Sun distance
- = 150,000,000 km (150 million km)
- = 93,000,000 mi (≈ 100 million miles is close enough)

NAME	SYMBOL	SIZE	DISTANCE FROM SOL	LENGTH OF DAY	LENGTH OF YEAR
MERCURY	☿	0.4 R <sub>⊕</sub>	0.4 AU	60 d <sub>⊕</sub>	1/4 y <sub>⊕</sub>
VENUS	♀	0.95 R <sub>⊕</sub>	0.7 AU	243 d <sub>⊕</sub> (R)	0.6 y <sub>⊕</sub>
EARTH	♁	1.0 R <sub>⊕</sub>	1.0 AU	1d <sub>⊕</sub>	1 y <sub>⊕</sub>
MARS	♂	0.5 R <sub>⊕</sub>	1.5 AU	1.03 d <sub>⊕</sub>	2 y <sub>⊕</sub>
ASTEROIDS		0.1 R <sub>⊕</sub>	3 AU	-----	5 y <sub>⊕</sub>
JUPITER	♃	11 R <sub>⊕</sub>	5 AU	10 h <sub>⊕</sub>	12 y <sub>⊕</sub> (≈ ONE CONSTELLATION OF THE ZODIAC PER YEAR)
SATURN	♄	9.5 R <sub>⊕</sub>	10 AU	10.25 h <sub>⊕</sub>	30 y <sub>⊕</sub>
URANUS	♅	4.1 R <sub>⊕</sub>	20 AU	17 h <sub>⊕</sub> (R)	85 y <sub>⊕</sub>
NEPTUNE	♆	3.9 R <sub>⊕</sub>	30 AU	16 h <sub>⊕</sub>	165 y <sub>⊕</sub>

#### - Earth as a planet

- interior  
 ([pubs.usgs.gov/publications/text/dynamic.html](http://pubs.usgs.gov/publications/text/dynamic.html), [www.livescience.com/topics/earth-s-interior/](http://www.livescience.com/topics/earth-s-interior/))  
 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 ([volcano.oregonstate.edu/](http://volcano.oregonstate.edu/))  
 types of volcanos: shield, cinder cone, composite & examples of each  
 plate tectonics & the motion of the continents  
 ([www.scotese.com/](http://www.scotese.com/), and [jan.ucc.nau.edu/~rcb7/global\\_history.html](http://jan.ucc.nau.edu/~rcb7/global_history.html))

-- oceans:

importance of water in the evolution of the atmosphere & life

*Heat Capacity:*

Energy required to raise (or lower) the temperature of a substance

*Latent heat:*

Heat released or absorbed when something (water) changes state

released: gas to liquid (condensation), liquid to solid (freezing)

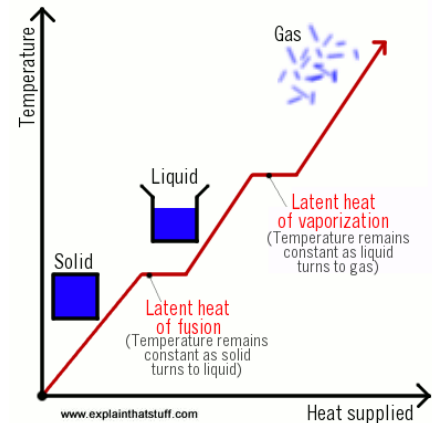
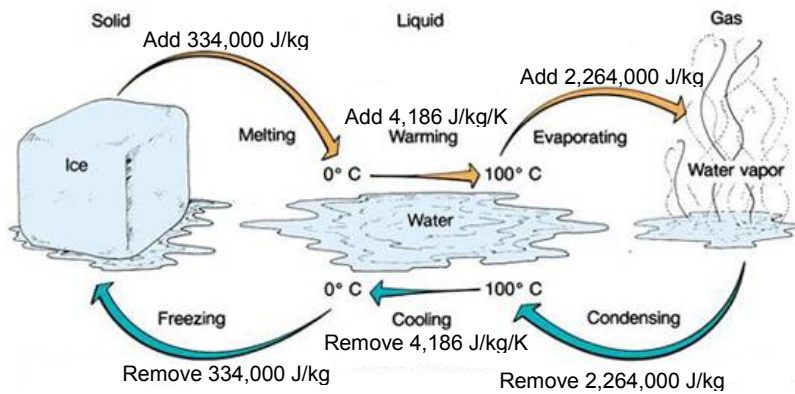
absorbed: solid to liquid (melting) or liquid to gas (evaporating)

*Heat transfer*

Conduction: Hot stuff heats neighbors (inefficient!)

Convection: Hot stuff moves

Radiation: Heat, itself moves



-- atmosphere

composition

primarily  $N_2$  (78%),  $O_2$  (21%), Ar (1%),  $CO_2$  (0.037%)

differs from Mars, Venus (How? Why?)

evolution of composition

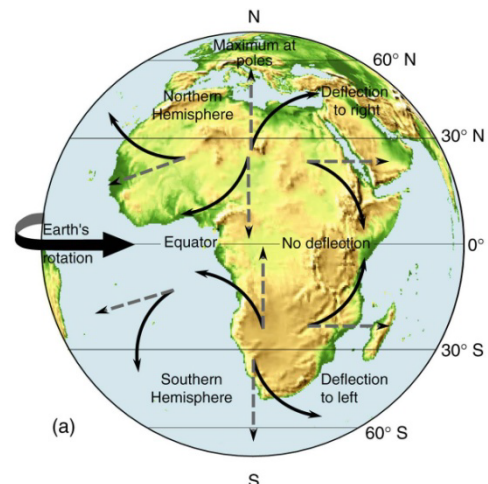
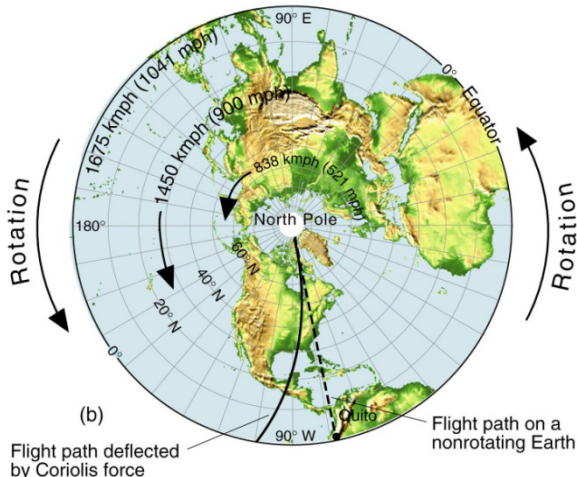
oceans absorbed  $CO_2$ , locked it into rocks ... what happened on Mars?

Plant & animal life generated and maintains  $O_2$  composition, evolution, circulation

forces on air

pressure gradient force (air moves from high to low pressure)

coriolis force (acts only on *moving* objects)



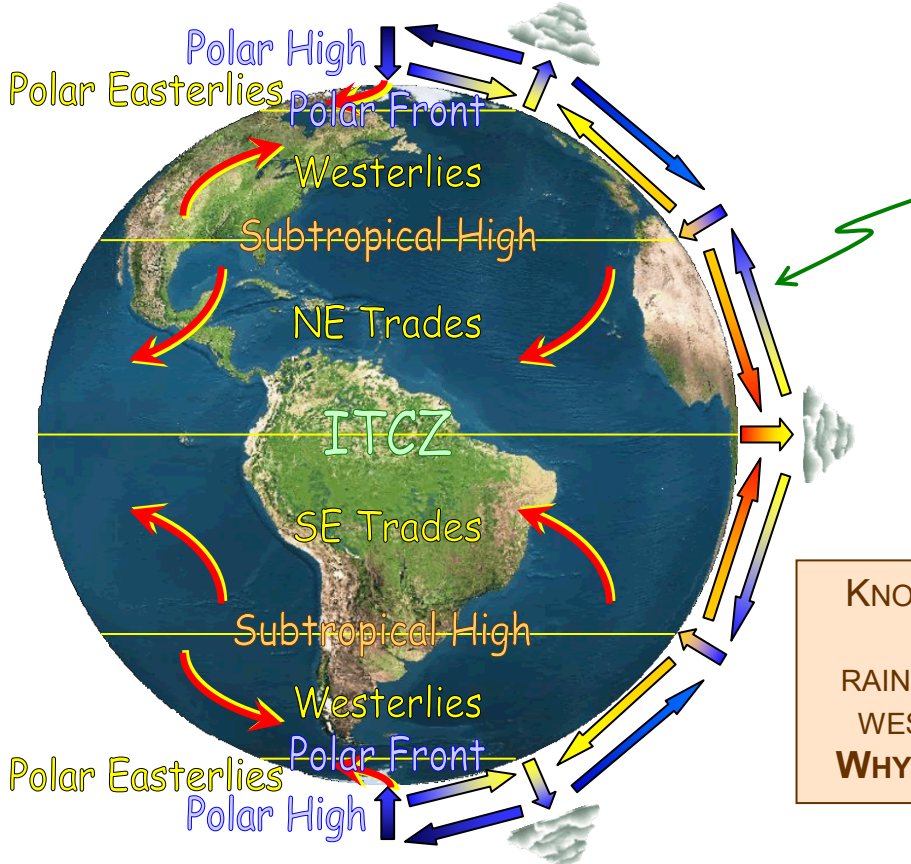
**PARTLY DRIVEN BY SUNLIGHT HEATING SURFACE AIR AT SUBSOLAR LATITUDE**

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



**PARTLY DRIVEN BY VERY COLD AIR SINKING AT POLES**

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



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?

**Greenhouse Effect**

Sunlight absorbed by ground heats it. Ground radiates IR that's absorbed by atmosphere

