Review for ASTR/ATOC 3720 Quiz #2

The Quiz (similar to Quiz #1 in format and style):

- Covers material from class, readings, and homeworks (helps to know old stuff)
- Will consist of calculations, short answers and some T/F
- No notes or books will be allowed
- I will give you constants and equations, but you'll have to figure out which ones to use, which ones are which, and what to plug into them!
- Calculators are allowed, but if I see that you've got notes stored in a handheld, I'll take it away and make you use my RPN calculator
- Bring a pen or pencil and your brain

New Topics Covered This Section:

- **Venus in the present:**
  - Basic properties of the planet and its surface
  - Atmospheric composition, temperature, etc.
  - Cloud layer
  - Surface motion of atmosphere
  - Superrotation of atmosphere at cloudtops
  - Greenhouse effect
- **Venus in the past:**
  - Runaway greenhouse effect
  - Role of water on Earth and Venus
  - Generic sources of atmospheric gases: planetary nebula, release during accretion, outgassing, later arrival via icy bodies, sublimation from surface, sputtering/micrometeorite impacts
  - Generic sinks of atmospheric gases: Thermal (Jean's) escape, hydrodynamic escape, non-thermal heating, sputtering/impact erosion, solar wind pickup, transport to other reservoirs
  - Maxwellian distributions, most probable speed, escape speed
  - Limiting rates
  - Saturation vapor pressure vs temp curves
  - D/H ratios and what they mean for water on Venus
- **Some Earth topics:**
  - Everything you know about Earth from the first part of the course
  - Chinooks, lee-waves, upslopes
  - Role of water in the present Earth atmosphere
  - Role of water in the early days of Earth's atmosphere
- **Mars in the present:**
  - Basic properties of the planet and its surface
  - Atmospheric composition, temperature, etc.
  - Martian polar caps, composition and cycles
  - Water cycle on Mars
  - CO_2 cycle on Mars and surface pressure changes
  - Seasons and the orbit of Mars
  - Dust storms on Mars

- **Mars in the past:**
  - Evidence for ancient climate change
  - Evidence for recent climate change
  - Timeline of Mars history
  - Where's the water? Where's the CO_2?

Reading done this section:

- The New Solar System: Chapters 8, 9, 11, **13 (most important)**

Equations (mostly old with a couple of new ones):

- Stefan-Boltzmann Law: $Power = Area \cdot \sigma \cdot T^4$
- Equilibrium or Effective Temperature: $T_e = \left(\frac{S_0 \cdot (1 - A)}{D^2 \cdot 4 \cdot \varepsilon} \right)^{1/4}$
- Ideal Gas Law: $p = nkT$
- Hydrostatic Equilibrium: $dp = -g \cdot n \cdot \bar{m} \cdot dz$
- Barometric Equation: $p = p_{ref} \cdot e^{-\frac{(z - z_{ref})}{H}}$, or $n = n_{ref} \cdot e^{-\frac{(z - z_{ref})}{H}}$
- Scale Height: $H = \frac{k \cdot T}{\bar{m} \cdot g}$
- Adiabatic Lapse Rate: $\frac{dT}{dz} = -\frac{g}{c_p}$
- Lambert-Beer Law: $I = I_0 \cdot e^{-\tau}$
- Optical Depth: $\tau = \int_s \sigma \cdot n \cdot ds$
- Wien's Law: $\lambda_{\max} = \frac{2.9 \times 10^6 nm \cdot K}{T}$
- Slab or Two-Stream Approximation: $T_g^4 = (1 + \tau) \cdot T_e^4$
- Column Density: $N = \int_s n \cdot ds$
- Most Probable Speed (peak of Maxwellian): $v_{max} = \sqrt{\frac{2 \cdot k \cdot T}{m}}$
- Gravitational Escape Speed: $v_{esc} = \sqrt{\frac{2 \cdot G \cdot M}{r}}$