Meteorology 3510 Start-of-course Quiz

- 1. Given T and p, what is the (formula to calcuate) density, ρ ?
- 2. Given ρ and the volume, V, what is the mass, M, of a sample of a gas?
- 3. What is the mass per unit area of a column of the atmosphere extending from the surface, where $p = p_s$, to the top where p = 0?
- 4. Determine the thickness of a layer of the atmosphere given the pressures at the bottom and top of the layer, p_1 and p_2 , and the average virtual temperature of the layer, $\overline{T_v}$?
- 5. What is the temperature change, ΔT , of a volume V of dry air at p, T, if heated by a lightbulb of with energy output of H Watts for one hour?
- 6. During a cold air outbreak from Siberia over the Sea of Japan, the temperature of the lowest 300 hPa of the atmosphere warms by 20° C, due to heating by the upper 30 m of the ocean. How much does this ocean layer cool as a result? If the energy transfer from ocean to atmosphere occurs over a 1-day period, what is the average rate of energy transfer (in units of W m⁻²)?
- 7. A parcel of dry air rises and expands adiabatically from $p = p_1$ where $T = T_1$ to $p = p_2$. What is $T_2 = T(p_2)$?
- 8. How much is a kilogram of air cooled by evaporating 5 g of water into it?
- 9. Define the LCL (lifting condensation level). How do you find it using a skew-T log p chart?
- 10. What is the definition of the dry adiatic lapse rate, Γ_d ? What is its theoretical value, in terms of physical constants? What is its numerical value?
- 11. What is the definition of the saturated adiatic lapse rate, Γ_s ? Does it have a fixed value? Is $\Gamma_s > \Gamma_d$?
- 12. What are the conditions, in terms of the actual lapse rate $\gamma \equiv -dT/dz$, Γ_d , and Γ_s , for absolute instability, absolute stability, and conditional instability?

- 13. Define the saturation mixing ratio, w, in words or with a mathematical expression.
- 14. Define relative humidity, RH.
- 15. Define the dewpoint temperature, T_d , in words or with a mathematical expression.
- 16. A radiosonde measures T, p, and RH. How can you obtain T_d from these quantities (either mathematically or using a skew- $T \log p$ chart?
- 17. What is CAPE (Convective Available Potential Energy)? Define it mathematically or using a skew- $T \log p$ chart.
- 18. What three processes lead to an air parcel having a its actual temperature be equal to θ , potential temperature, θ_e , equivalent potential temperature, and T_w , wet-bulb temperature?
- 19. How do mixing ratio and θ_e change as air flows into a hurricane isothermally but with pressure decreasing, if its relative humidity remains constant?
- 20. What produces turbulence?
- 21. What are the shapes of typical potential temperature and wind profiles in the lowest 100 meters of the boundary layer on a clear summer day over land?