Chapter 1: Earth’s Atmosphere
1. Weather vs. climate
2. A brief history of the atmosphere
3. The composition of the Earth’s atmosphere (approximate amounts and major gases)
   a. Permanent gases and percentages (N$_2$, O$_2$, Ar, Ne, He, H$_2$, Xe)
   b. Variable gases (H$_2$O, CO$_2$, CH$_4$, N$_2$O, O$_3$, particulates, CFCs and HCFCs)
4. Greenhouse gases - common ones and their relative importance (H$_2$O, CO$_2$, CH$_4$, N$_2$O, CFCs)
5. Common pollutants (particulates, NO$_2$, CO, hydrocarbons, O$_3$)
6. Atmospheric pressure vs. altitude (and roughly why)
7. Temperature variations with height
   a. The “normal” lapse rate in the troposphere = 6.5 °C/1000m = 3.6 °F/1000 ft.
   b. A temperature inversion - what is it?
8. The layers of the atmosphere and what characterizes each
   a. Troposphere, Tropopause, Stratosphere, Stratopause, Mesosphere, Mesopause, Thermosphere, Exosphere
   b. Ionosphere (above 60 km from the Earth)
   c. The difference between the Homosphere and the Heterosphere

Chapter 2: Warming and Cooling Earth and Its Atmosphere
1. The definitions of energy and kinetic energy
2. The definition of heat
3. Temperature is proportional to the kinetic energy of the molecules
   a. kinetic energy is proportional to $v^2$
4. Temperature scales - Fahrenheit, Celsius, and Kelvin
   a. Conversions between the scales
5. Latent heat of fusion and latent heat of evaporation
   a. $Q = m L_f$ or $Q = m L_v$ ($L_f$ is the latent heat of fusion/melting, $L_v$ is the latent heat of vaporization or condensation)
   b. The approximate values for water
6. Conduction, convection, advection, radiation
7. Everything warmer than 0 K emits radiation
   a. Stefan-Boltzmann law, $E = \sigma T^4$ ($E$ is energy radiated/area of radiator)
   b. Wien’s law, $\lambda_{max} = 3000 \mu m \cdot K/T$
8. Regions of electromagnetic spectrum and approximate wavelength boundaries
   a. Ultraviolet, Visible, Infrared
9. Temperature of Sun and Earth and approximate peak emission wavelengths
10. Blackbody definition
11. Radiative equilibrium temperature (definition and earth’s)
12. Kirchoff’s law (good absorber=good emitter at given wavelength)
13. Selective absorbers
14. Atmospheric greenhouse effect
   a. Greenhouse gases
b. Atmospheric window

15. Warming of the Troposphere (how)
16. The solar constant (at the top of the atmosphere = 1361 W/m²)
17. Scattering, reflection, and albedo - effect on heating the atmosphere
18. Energy balance for the earth - processes involved
19. Why we have seasons
20. The effect of the following on the seasons
   a. The tilt of Earth’s axis - the angle of sunlight, the length of day, the thickness of the atmosphere (due to the angle the sunlight passes through the atmosphere)
   b. The variation in Earth’s distance from the Sun
   c. The variation in the duration of the seasons
21. Local seasonal variations (terrain, vegetation, etc. effects)

Chapter 3: Air Temperature
1. How a radiation inversion develops
2. The “thermal belt”
3. Protecting crops from freezing
4. The daily temperature cycle in the atmosphere
5. Regional temperature variations
   a. “Local” controls of temperature (four are listed)
6. Qualitative familiarity with the isotherm maps on p. 66
7. Reported temperature values (definitions)
   a. Daily maximum, daily minimum, daily range of temperature, mean daily temperature
      i. The definition of a “normal” temperature for a given date
   b. Monthly average
   c. Mean annual temperature and annual range or temperature
   d. Applications of air temperatures
      i. Heating degree-days, cooling degree-days, growing degree-days
8. Sensible temperature (the way the air feels to a human)
   a. Factors that affect the sensible temperature
   b. Wind-chill equivalent temperature
9. How temperatures are measured - correct conditions to get a good measurement

Chapter 15:
1. Scattering - Rayleigh, geometrical
2. Refraction
3. Dispersion
4. Reflection
5. Diffraction and interference
6. Reasonable understanding of the following (what they are and what causes them; one or more of: scattering, refraction, dispersion, reflection, diffraction, and interference)
   a. Blue sky and red sunset
   b. Blue Haze
   c. White Clouds
   d. Crepuscular rays
   e. White haze
f. Twilight

g. Green flash

h. Elliptical sun/moon and image displacement

i. Twinkling stars

j. Mirages - inferior and superior

k. Halos (22° and 46°)

l. Tangent arc

m. Sundogs

n. Sun pillars

o. Rainbows - primary and secondary

p. Corona and iridescence

q. Glory, brocken bow, heligenschein