1. Using wet bulb temperature to determine relative humdity
   a. Start with eq. (16) from the diffusion to cloud droplet notes

$$\frac{\left[\rho_v(\infty)-\rho_v(r_{drop})\right]}{\left[T\left(r_{drop}\right)-T(\infty)\right]}=\frac{K}{LD_v} \tag{16}$$

   Take the conditions over the wet gauze over the wet bulb thermometer as the air over the droplet in (16). Use the Claussius Clapeyron equation without any curvature to represent the saturation conditions over the wet gauze and assume the air over the gauze is saturated.

   a. Show that given a measurement of the air temperature (dry bulb) and the wet bulb temperature that the water vapor mass density of the air is

$$\rho_{v-env}=\frac{e_s\left(T_{wb}\right)}{R_vT_{wb}}-\frac{K}{LD_v}\left[T_{air}-T_{wb}\right]$$

   b. Show the water vapor pressure of the air is

$$e_{env}=R_vT_{env}\left\{\frac{e_s\left(T_{wb}\right)}{R_vT_{wb}}-\frac{K}{LD_v}\left[T_{env}-T_{wb}\right]\right\}$$

   c. Show the relative humidity of the air is

$$RH=\frac{R_vT_{env}\left\{\frac{e_s\left(T_{wb}\right)}{R_vT_{wb}}-\frac{K}{LD_v}\left[T_{env}-T_{wb}\right]\right\}}{e_s\left(T_{env}\right)}$$

   Assume the air pressure is 1000 mb, the air temperature is 283 K and the wet bulb temperature is 273K,

   d. what is the water vapor mass density of the air,
   e. what is the water vapor pressure of the air and
   f. what is the relative humidity of the air.
   g. Show that the dew point depression (T-T_d) is indeed about 3 times the wet bulb depression (T-T_{wb})

2. Based on the figure at the end of the **Diffusion of water vapor onto a cloud droplet** notes, approximately how long would it take for a cloud droplet to grow to 1 mm in radius?

3. For a NaCl CCN of mass $3\text{x}10^{-19}$ kg, and a temperature of 288 K
   a. Determine the CCN radius before the water begins condensing on it
   b. Determine the constants, *a* and *b* in eq. (10) in **Cloud Droplet Formation** notes
   c. Determine the peak supersaturation, S*, in the Kohler curve for this CCN
   d. Determine the corresponding radius, r*
   e. Plot the Kohler curve for this CCN

4. Aerosol indirect effects
   a. Explain the two aerosol indirect effects and their relation to autoconversion
   b. Explain why an increase in manmade aerosols may reduce global warming

SHOW ALL WORK