Exercise Lecture 3

Note (you don't have to send me the answers for questions (1 and 5), but later you have to find the answers!!!!

Q1/ Use the Clausius-Clapeyron equation to find the saturation vapor pressure at T = 1°C , and T_0 = 273K, e_0 = 611 Pa, and L_v = 2.5x10^6 J/kg, R_v is 461 J/kg K) . Answer: 657 Pa

Q2/ An air sample at standard sea level pressure (1013 hPa), and with a volume of 1m^3 at 20°C, contains 7 grams of water vapor, use the following when you need(T_0 = 273K, e_0 = 611 Pa, and L_v = 2.5x10^6 J/kg, R_v is 461 J/kg K,R_d=287.1J/kg.k).

a. What is the vapor pressure (use the ideal gas law and don't forget to convert to kg)? Answer: 946 Pa

b. What is the relative humidity (you need to find the saturation vapor pressure)? Answer: 39.9%

c. What is the absolute humidity? (Absolute humidity is merely the density of the water vapor, ρ_v) Answer: 7 g/m3

d. What is the mixing ratio? Answer: 0.0058 kg/kg

e. What is the specific humidity? (Use the equation $q = \frac{R_d}{R_v}\frac{e}{p}$), answer: 0.00581 kg/kg

f. What is the dew-point temperature? Answer: 279°K

Q3/ Fill in the blanks

1. Moist air is a mixture of …… and ……..
2. Vapor pressure is proportional to the …….. , while saturation vapor pressure is proportional to the …… .

3. The ……. (lower/higher) the amount of water vapor, the higher the absolute humidity.
4. Heat energy is released in …….. (evaporation/condensation) ……..(from/into) the environment.
5. The difference between mixing ratio and specific humidity is ……

Q4/ Determine if the following statements true or false?

1. Absolute humidity will change as the air parcel is heated or cooled.
2. Relative humidity does not directly tell us how much water vapor is in the parcel.
3. Air will have a lower relative humidity if the air is cooler with the same amount of absolute humidity
4. Virtual temperature is always greater than or equal to the actual temperature.
5. Saturation is when saturation vapor pressure $(e)_s$ is larger than vapor pressure (e).

Q5/ Answer the following questions

1. What is the saturation vapor pressure?
2. What are the differences between absolute, specific and relative humidity?
3. How can relative humidity be changed?
4. How can specific humidity be changed?
5. How can we find the partial pressure of a gas?
6. Which expression is more convenient to meteorologist?