87.202 - PRINCIPLES OF EARTH & ENVIRONMENTAL SYSTEMS II
STUDY QUESTIONS AND PROBLEMS III

1. What is meant by saturated air? If there are no particles suspended in the air, why doesn't condensation occur when the relative humidity exceeds of 100%.

2. Distinguish between absolute humidity and relative humidity. What is meant by the dewpoint temperature?

3. Why does the saturation adiabatic lapse rate vary as a function of temperature?

4. Name and describe the four types of fog. How does each type form?

5. Discuss the ways in which raindrops can form in a cloud.

6. An air parcel has a mixing ratio of 8.31 gms kg^{-1}. Calculate the dewpoint temperature (Use Table 1. Saturation mixing ratios). This air parcel is initially at a temperature of 16 °C, the same temperature as the surrounding air. The environmental lapse rate is 8°C km^{-1}. Because of a mountain blocking its path the air parcel is forced to rise to a height of 2 km. At his height is the air parcel stable or unstable with respect to the surrounding atmosphere? Calculations are required. For the air parcel assume a wet adiabatic lapse rate of 6°C km^{-1}. (ans: Dewpoint T = 11°C, Unstable T_{Envir} = 0°C, $T_{air\ parcel}$ = 4°C)

7. The latent heat of evaporation of water, at any temperature T, can be determined using the following equation:

$$L = 596 - 0.52T \qquad \text{where T is in °C.}$$

Calculate the amount of heat energy released by 1 kg of saturated air in cooling from 20°C to 19°C and in cooling from 1°C to 0°C. (ans: 568.3 cal, 172.8 cal)

Table 1. Saturation Mixing Ratio (gm kg^{-1}) over water at 1000 mb

	Temperature (^{o}C)									
	0	1	2	3	4	5	6	7	8	9
40	49.8									
30	27.7	29.4	31.2	33.1	35.1	37.3	39.5	41.9	44.4	47.0
20	15.0	15.9	17.0	18.1	19.2	20.4	21.7	23.1	24.6	26.1
10	7.76	8.31	8.88	9.49	10.14	10.83	11.56	12.34	13.16	14.03
0	3.84	4.13	4.44	4.77	5.12	5.50	5.89	6.32	6.77	7.23
0	3.84	3.57	3.31	3.08	2.85	2.64	2.45	2.27	2.10	1.94
-10	1.794	1.656	1.529	1.410	1.300	1.197	1.110	1.013	0.931	0.855
-20	0.785	0.720	0.659	0.604	0.552	0.505	0.461	0.421	0.384	0.350
-30	0.318	0.289	0.263	0.239	0.217	0.196	0.178	0.161	0.145	0.131