

Name: _____

Quiz Section: _____

ATMS 101
Autumn 2013

Homework #3

Due: Thursday, November 7, 2013 at the **beginning** of class

Please show all your work.

#1. On a cool, clear night with light winds, the air temperature falls while the dew point temperature remains steady. At some point, the air becomes saturated and fog begins to form. After the fog develops, the dew point temperature drops. Why?

#2. Why do farmers spray water on crops in danger of freezing on a cold night?

#3. A parcel of air at sea level in western Washington has a temperature of 10°C and is saturated. (For this problem, you may assume the moist adiabatic lapse rate Γ_s is $6.2^{\circ}\text{C}\cdot\text{km}^{-1}$ and that the dry adiabatic lapse rate Γ_d is $9.8^{\circ}\text{C}\cdot\text{km}^{-1}$.)

(a) The parcel is forced to rise to an elevation of 2 kilometers at the crest of the Cascade Mountains. What is its new temperature?

(b) After passing the Cascade crest, the parcel descends dry adiabatically down the east side of the mountains to an elevation of 500 meters. What is its new temperature?

#4. The environmental lapse rate is $8^{\circ}\text{C} \cdot \text{km}^{-1}$. (You may assume the same values of Γ_s and Γ_d as in #3.)

(a) If an unsaturated air parcel is displaced upwards, will it continue to rise? Why?

(b) If a saturated air parcel is displaced upwards, will it continue to rise? Why?

#5. The mixing ratio w of a parcel is $3.5\text{g} \cdot \text{kg}^{-1}$. The temperature of the parcel is 0°C so the saturation mixing ratio w_s is $3.8\text{g} \cdot \text{kg}^{-1}$. What is the relative humidity of the parcel?

#6. Why do rain drops fall out of the sky while cloud droplets do not?
