AT350

Concepts that matter. Second part of course. Fall 2009.

It is a cold, clear winter night. As the temperature drops near the surface, what happens to the dew point and relative humidity? Now imagine a fog cloud forms. What type of fog is this? What is the relative humidity now? As the fog layer grows, what happens to the relative humidity and the dew point temperature?

List the main types of fog and briefly explain how each one forms. Where might you expect each of these different types of fog to form?

If you hold water vapor constant, consider how changing temperature affects the dew point temperature, the vapor pressure, and the saturation vapor pressure.

If you hold temperature constant, consider how changing the amount of water vapor in the air affects the dew point temperature, the vapor pressure, and the saturation vapor pressure.

Be sure to understand dew point, relative humidity, vapor pressure and saturation vapor pressure, and how to calculate all of these variables.

List one or more key identifying features for each of the ten basic cloud types. Consider the absorption and emission of longwave by each cloud type.

Be sure to be able to calculate cloud base given a range of different surface conditions.

Explain why clouds form in rising air. Would it be possible for rising air to remain cloud-free?

Try the following problems with a variety of different mountain heights and starting conditions:
1. Start with parcel at the base of a mountain. Assign it a temperature and dew point temperature.
2. Assume the parcel is lifted up the mountain. Calculate the cloud base.
3. Assume the parcel is lifted above the cloud base. Calculate the temperature and dew point as the parcel is lifted to the top of the mountain (you choose the height).
4. Calculate the temperature and dew point as the parcel is returned to 0 meters on the downwind side of the mountain.

An air parcel that is warmer than its surroundings will rise. What force accounts for this upward motion?

Does radiational cooling at the ground at night act to increase or decrease atmospheric stability? How does daytime heating at the ground during the day affect atmospheric stability?

Explain how lifting an air layer can steepen the environmental lapse rate and make the layer more unstable.

What types of clouds might you expect to see form when a cold mass of air moves over warmer water?

Given a vertical profile of temperature, be able to calculate cloud base, and be able to calculate the temperature and dew point temperature of a rising parcel as it ascends within the cloud.

For the following conditions, determine the actual water vapor pressure, saturation water vapor pressure, and relative humidity:

a) T=10 C; dew point =10 C.
b) T=40C; dew point = 10C.
c) T= 30C; dew point = 20C.

For the following conditions, estimate the actual water vapor pressure and dew point temperature.

a) T= 30C; relative humidity=50%.

b) T= 20C; relative humidity=100%.
c) T=35 C; relative humidity=80%.

For the following conditions on a warm summer afternoon, estimate the cloud base height above the surface.

a) T=32C; dew point T=15C.
b) T=32C; dew point T=10C.
c) T=32C; dew point T=30C.
d) T=30C; relative humidity=50%.
e) T=30C; relative humidity=90%.
f) T=30C; relative humidity=10%.

Explain what the lifting condensation level is.

Explain why condensational heating is important in convective cloud development.