Name:_____ Section:_____

Atmospheric Sciences 101, Spring 2008
Homework 4 (Due at the beginning of your section, Thursday May 8th or Friday May 9th)

Turn in by 4:30 PM on the due date to receive 75% of possible credit
No assignments accepted after 4:30 PM on the due date

1. Gas Law

Visit the web address below and use the GAS LAW DEMONSTRATOR to answer the following questions. You can also access the link through the Atmospheric Science 101 homework page.

http://intro.chem.okstate.edu/1314F00/Laboratory/GLP.htm

NOTE: The ideal gas law can be written as: PV = nRT, where P is the pressure, V is the volume, n is proportional to the number of particles of the gas, R is a constant, and T is the temperature. OR alternatively the ideal gas law can be written as: Pressure = Density x Temperature x Constant.

A. Click on the volume button [V]. See how the volume behaves when the other variables change. To change a variable adjust the slide bars. How does the volume change with:

(i) an increase in the number of gas molecules [n]

(ii) an increase in the pressure of the gas [P]

(iii) an increase in the temperature (velocity) of the gas molecules [T]

B. If all the other components were left unchanged;

(i) What would happen to the pressure (click on [P] button) and density if the volume was increased with the number of molecules and temperature remaining constant?

(ii) What would happen to the temperature (click on [T] button) and density if the volume was increased with the number of molecules and pressure of gas remaining constant?

2. Cloud Identification

The accompanying web page (link after the homework link) shows a number of different cloud types. State their correct names.
Address: http://www.atmos.washington.edu/steed/clouds/

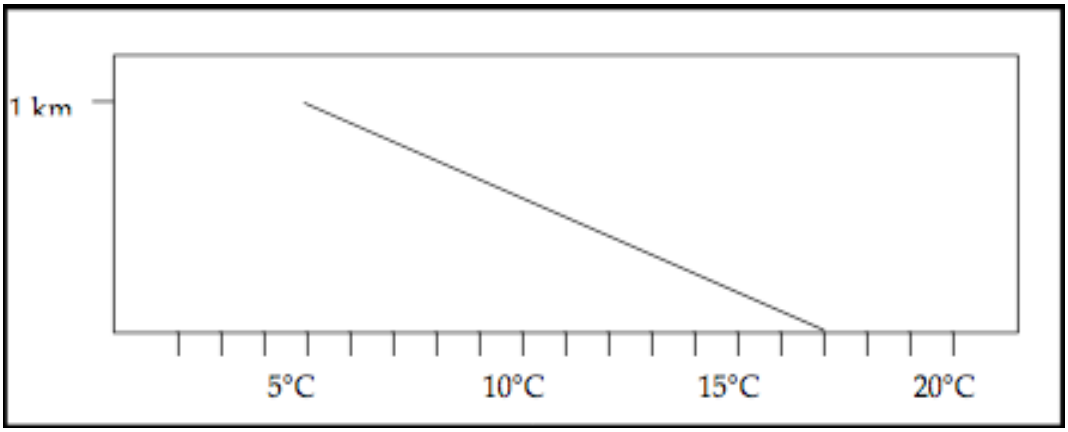
a. _____ d. _____

b. _____ e. _____

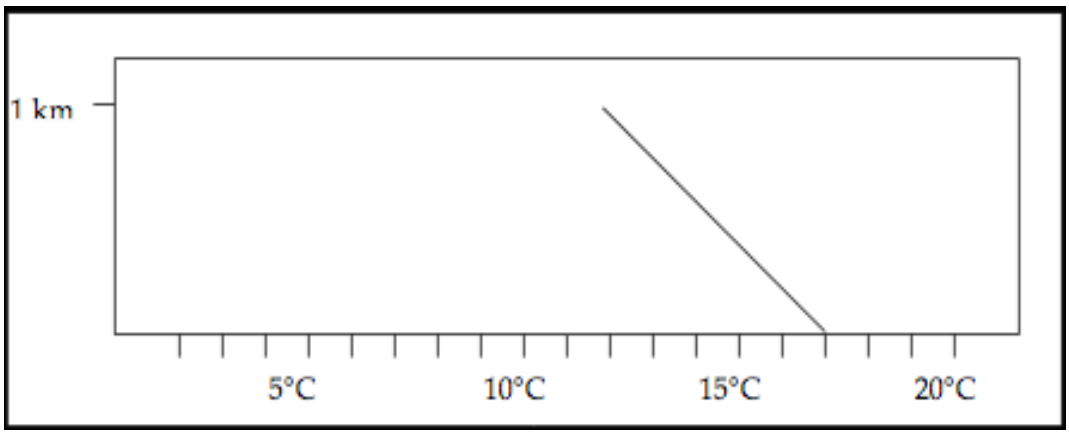
c. _____ f. _____

3. Atmospheric Stability Profiles

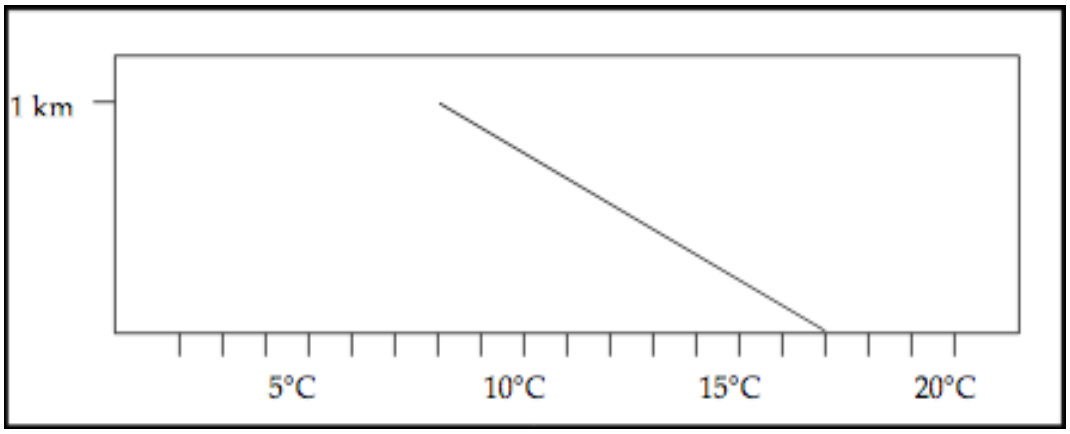
The diagrams on the following page show the temperature of the lowest 1 km of the atmosphere, i.e. they represent the ENVIRONMENTAL LAPSE RATE. On the following diagrams, using a straight-edge, draw in lines representing the DRY ADIABATIC LAPSE RATE and the MOIST ADIABATIC LAPSE RATE (use 6 C/km) starting at the same surface temperature (17°C). Based on the information presented, indicate the stability of the three environments belowwith respect to vertical motions: choose either "stable", "unstable", or "conditionally unstable." "Conditionally unstable" means that air rising at the dry adiabatic lapse rate will be stable but air rising at the moist adiabatic lapse rate is unstable.



Stability:_____



Stability:_____



Stability:_____

4. Stability of Saturated and Unsaturated Parcels

The temperature is 20° C and two parcels of air are lifted from the ground to an altitude of 1 km. Parcel A is very dry (RH=30%) and parcel B is very moist (RH=100%). The environmental lapse rate (the rate at which temperature decreases with height in the surrounding air) is 8° C per km.

a. [parcel A] [parcel B] [both parcels] [neither parcel] will continue to rise beyond 1 km.

b. [parcel A] [parcel B] [both parcels] [neither parcel] will sink back to the ground.

c. [parcel A] [parcel B] [both parcels] [neither parcel] will form a cloud as it rises.

d. [parcel A] [parcel B] [both parcels] [neither parcel] will explode and catch on fire.

5. Entrainment

Two clouds are forming over two separate, but identical mountain tops. Environmental lapse rates are also identical. The only difference between the two scenarios is that one mountain is surrounded by air at 25% humidity and the other by air at 95% humidity. Which cloud would you expect to grow more quickly and why?