

Name: _____
Time of Class: _____
Due Date: _____

Regional Climatology

Lab Number One Atmospheric Processes

Part I: Group Discussion and Answer

Directions: Arrange a group of three to five individuals. Discuss each of the following questions. As a group, outline the answers to each question. You may omit one question. The answers do not need to be in essay format, but they should be complete. Use bullet points. Each group should hand in only one answer sheet. Recall, that I gave you permission to individually turn in the completed answers.

1. Describe what happens to insolation when clouds are in the troposphere. What portion of the Earth's total energy budget is absorbed, reflected or scattered by clouds. Discuss the role clouds play in greenhouse forcing and albedo forcing.
2. What causes the seasons? Discuss the roles of the equator, tropics of Cancer, Capricorn, and the Arctic and Antarctic Circles in relationship to the seasons.
3. Discuss conduction, convection, advection, and condensation as they relate to the global energy budget.
4. Given what you now know about reflection, albedo, absorption, and net radiation expenditures, assess your wardrobe (fabrics and colors), house or apartment (colors of walls and roof, orientation relative to the Sun), automobile (color, use of sun shades), bicycle seat (color), and other aspects of your environment to determine a personal "energy IQ". What grade do you give yourself? Each person in the group should create an "energy IQ". As a group calculate an average and express your group "energy IQ" as a percent. Have fun!
5. "The atmosphere is mostly heated directly from the Earth rather than from the Sun." Comment on the validity of this statement.
6. Define and discuss thermally induced horizontal variations in atmospheric pressure.
7. Define and discuss dynamically induced horizontal variations in atmospheric pressure.
8. All freely moving objects which travel across Earth's surface or atmosphere appear to drift to the right in the northern hemisphere as a result of Earth's rotation. This apparent deflection is called the Coriolis effect. All winds and ocean currents are influenced by the Coriolis effect. Explain the rightward deflection of an object shot from 40 degrees latitude in California that misses its target located at 40 degrees latitude in Pennsylvania (west to east). Conversely, explain the rightward deflection of an object shot from 40 degrees latitude in Pennsylvania that misses its target located at 40 degrees latitude in California (east to west).

Part II: Terms and Concepts

Directions: Concisely define the following terms in the space provided.

1. Latent heat of condensation
2. Sketch atmospheric circulation on a non-rotating Earth.
3. Circle of Illumination
4. Earth's Average Albedo is: _____.
5. Diffuse radiation
6. Coriolis effect "undershoot"
7. Down the pressure gradient
8. Centripetal Force/Acceleration

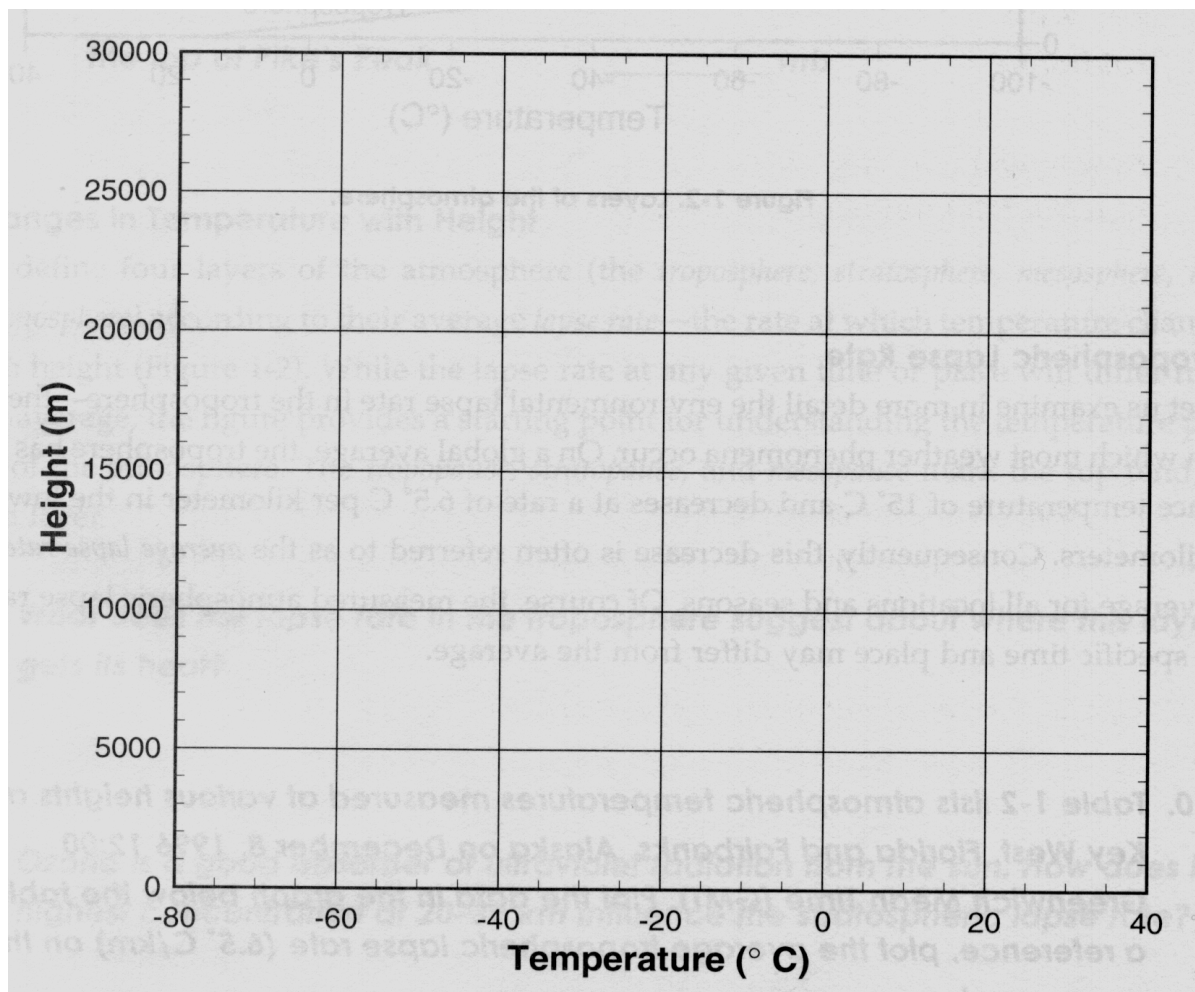
Part III: Sketching and Short Answer

1. In the space provided, diagram the electromagnetic spectrum.
2. Diagram a radiation inversion. Illustrate the lapse rate with increasing altitude.

3. Let us examine in more detail the normal lapse rate in the troposphere—the layer in which most weather phenomena occur. On a global average, the troposphere has a surface temperature of 15 degrees C and decreases at a rate of 6.5 degrees C per kilometer in the lowest 11 kilometers. Consequently, this decrease is often referred to as the *average lapse rate*—the average for all locations and seasons. Of course, the measured atmospheric lapse rate for a specific time and place may differ from the average.

The table lists atmospheric temperatures measured at various heights above Key West, Florida and Fairbanks, Alaska on December 8, 1996 12:00 Greenwich Mean Time. Plot the data in the graph below the table. As a reference, plot the average tropospheric lapse rate (6.5 degrees C/km) on the same graph. Recall that there are 1000 meters per kilometer. (I know that I told the class that I would generally use U.S. standard units. Sometimes, I find data only in metric. I am not converting the data.)

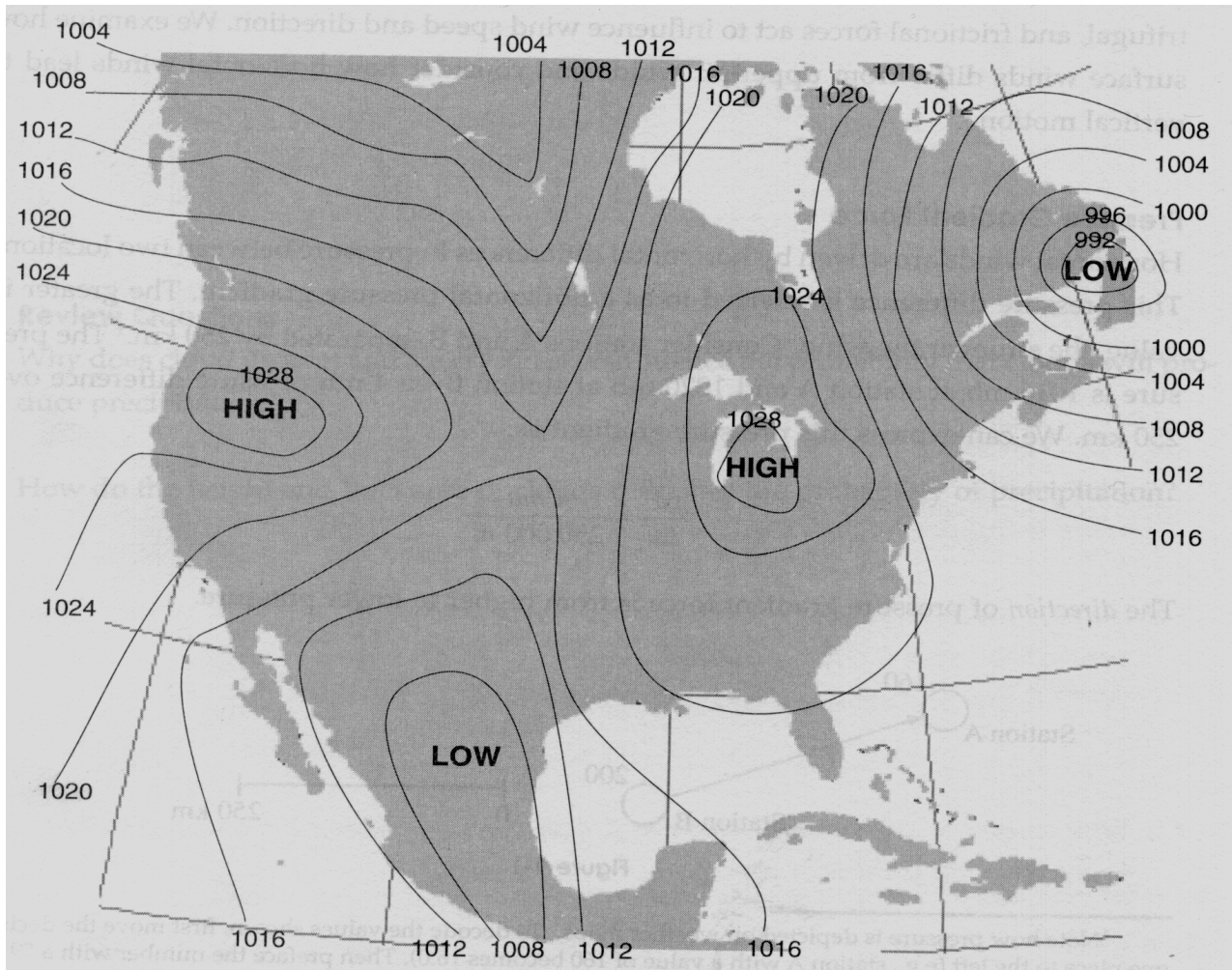
Key West, Florida										
Height (m)	surface	800	3300	5300	7500	12000	16000	17000	20500	28000
Temp. (°C)	24	18	7	-6	-21	-57	-74	-74	-62	-56
Fairbanks, Alaska										
Height (m)	surface	400	900	3000	5000	9000	10000	16000	20000	28000
Temp. (°C)	-26	-11	-7	-22	-30	-60	-51	-48	-47	-52



- a. Which station has the higher surface temperature? _____
- b. Which station has the higher temperature at 10 kilometers? _____
- c. How does the temperature profile in the lowest 1 kilometer differ between the two stations?
- d. The tropopause marks the top of the troposphere is defined as the height of the coolest tropospheric temperature. Record the tropopause height at Key west and Fairbanks and their respective temperatures.

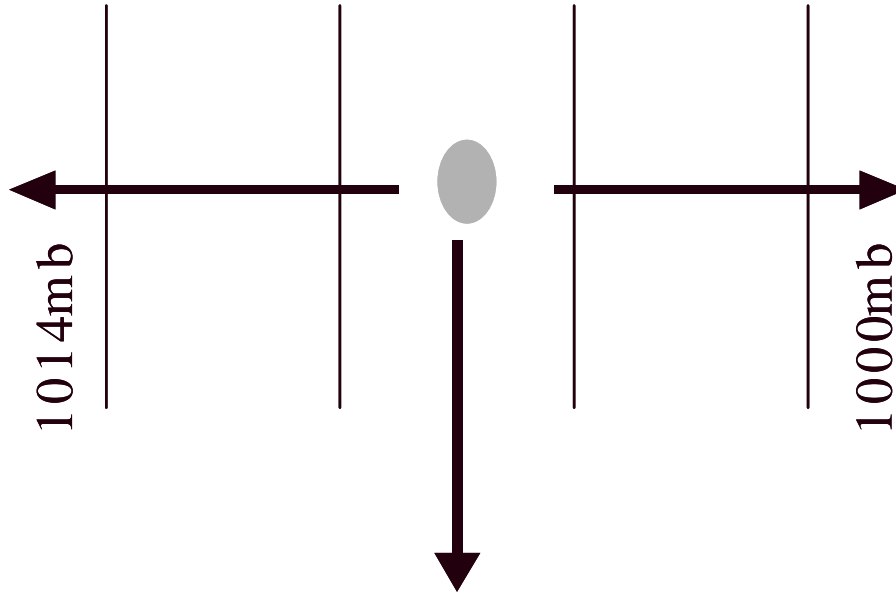
	Tropopause Height	Tropopause Temperature
Key West	_____	_____
Fairbanks	_____	_____

4. On the map below:
 - a. Circle the area with the greatest pressure gradient.
 - b. Use arrows to show the direction of pressure gradient force at a few locations.
 - c. Label a region where you could expect the lightest winds.



5. Label the appropriate arrow in Figure 1 with the following information: high pressure, low pressure, Coriolis effect, pressure gradient and geostrophic wind. **Using a colored pencil, redraw the arrows with consideration to surface friction.**

Figure 1: Geostrophic Wind



6. Go to the Net. Find the Weather Channel Home page - <http://www.weather.com/> Next, browse areas for the state of New York. Locate weather conditions for Oneonta (http://www.weather.com/weather/cities/us_ny_oneonta.html). Log the requested information at approximately the same time for all five day. It is OK to use another Internet source other than weather.com. You may use the local newspaper. Identify and discuss trends between barometric pressure, air temperature and wind for the five days.

Date & Time of Day	Barometric Pressure	Temperature	Wind Speed & Direction
Day 1:			
Day 2:			
Day 3:			
Day 4:			
Day 5:			

7. Go to <http://www.worldclimate.com/>. What are the average temperature and precipitation values for the months of January and July?