Name: **Solutions** Section/TA: _____

Atmospheric Sciences 101, Spring 2003
Homework #1 - Due in section Thursday/Friday, 3/4 April 2003

1. Precipitation across Washington State varies tremendously from location to location due to many features, some of which include predominant storm tracks as well as the existence of mountainous regions. We will compare five locations across the state and consider their average annual precipitation. First locate the following locations: Seattle, Forks, Yakima, Olympia, and Spokane on a state map. Once located, use 1961-1990 average annual precipitation data across Washington State to rank the amounts of precipitation experienced at these locations, on average, from wettest to driest. Be sure to also include the precipitation amounts (the range shown on map).

   (Average Annual Precipitation Data for Washington is located at the following link: http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/WA/wa.gif)

		Location	Average Annual Precipitation (inches)
Wettest	1.	**Forks**	**100-140 (accept 80-100)**
	2.	**Olympia**	**40-60**
	3.	**Seattle**	**30-40**
	4.	**Spokane**	**10-20 (accept 20-30)**
Driest	5.	**Yakima**	**Under 10**

2a. Specify whether the following measurements describe weather OR climate

	Weather	Climate
Highest recorded temperature in Seattle for July 15th		**X**
Average number of clear days per year in Phoenix, Arizona		**X**
Highest recorded wind speed at Sea-Tac on December 13, 2002	**X**	
Mean March snowpack at Mt. Baker		**X**
Measured humidity in Tampa, Florida last Monday	**X**	

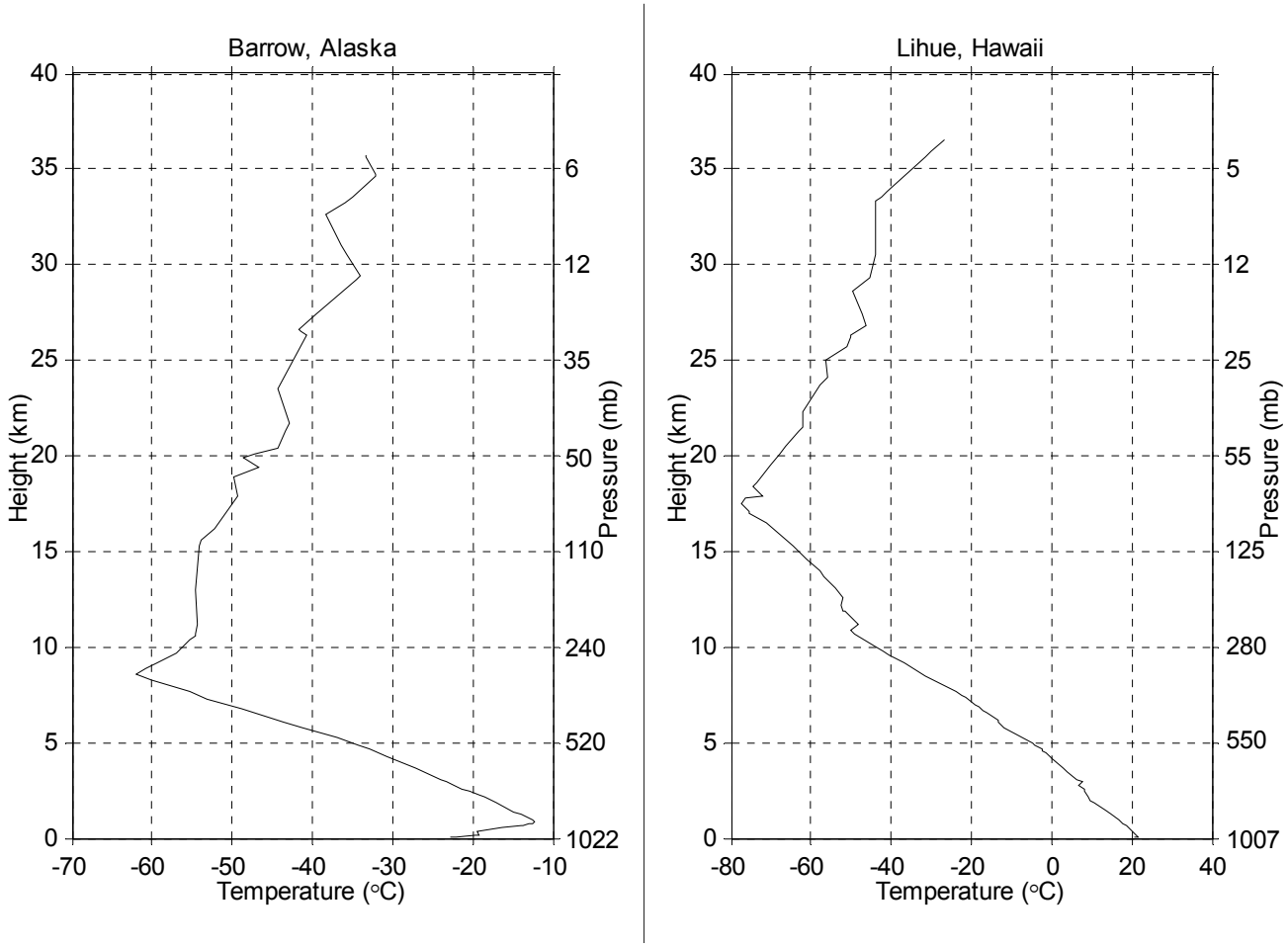
2b. Specify whether the following are examples of convection OR conduction OR radiation.

	Conduction	Convection	Radiation
A microwave heating your food			**X**
Ashes rising above a fire		**X**	
Your mug filled with hot coffee feels warm	**X**		
You feel warm when facing the sun			**X**
An eagle soaring without flapping its wings on a hot sunny day.		**X**	

3. Consider a red balloon and a burning red coal. In the light both appear red. However, when it is dark you are no longer able to see the balloon yet the coal still shines red. Explain why this is so.

   The balloon's temperature is too low for it to emit visible light, so you are seeing ambient light reflecting off of it. When this ambient light goes away (it gets dark) you can no longer see the balloon. The coal is black or gray when cool, but you see it as red when it is hot because it is emitting red light. So, since the coal is emitting the light you are seeing, it can still be seen without ambient light.

4. The following figure shows soundings (temperatures at different heights or pressure levels) from Barrow, Alaska, and Lihue, Hawaii. The soundings were taken at the same time, 12:00 GMT (3:00 am Alaska Time, 2:00 am Hawaii Time) on 31 March 2003. Use them to answer the questions that follow.



a. Approximately what is the height (km) and pressure level (mb) of the tropopause at

Lihue, HI? **17.5 km, 90 mb (accept 16-19 km, 110-60 mb)**

Barrow, AK? **8.5 km, 320 mb (accept 7.5-9.5 km, 250-420 mb)**

b. At which station is the lowest temperature recorded? Approximately what is this temperature and at what height is it observed?

Lihue, –78°C , 17.5 km (accept –70° to –80°C, 16-19 km)

c. Approximately what is the temperature (Please give your answers in both °F and °C) at 5 km at

Lihue, HI? **–5°C, 23°F (accept –1° to –11°C)**

Barrow, AK? **–35°C, –31°F (accept –32° to –38°C)**

d. Which station has a temperature inversion near the surface? **Barrow, Alaska**

5. In what range of wavelengths would a cream have to absorb for it to be an effective sunscreen? Please give the range in micrometers (μm) and the name for the range (visible, UV, IR, radio, etc.). Hint: see page 33 in EOM text.

Ultraviolet Range: 0.2-0.4 μm

In what range of wavelengths does an atmospheric gas have to absorb for it to be an effective greenhouse gas? Again, please give the range in micrometers and the name.

Infrared Range: 5-25 μm

Although, the IR spectrum includes wavelengths between 0.7 and 350 μm, an efficient greenhouse gas needs to absorb in the above range, which corresponds to the wavelengths emitted by the Earth's surface. (See figure 2.8)