ES 106 Laboratory # 7
WEATHER – OREGON CLIMATE

Introduction

Climate is the measure and description of average weather conditions for a place on Earth's surface over time. Earth's climate system is very complex. The atmosphere, hydrosphere (mostly oceans), lithosphere, cryosphere (ice), and biosphere all contribute to Earth's climate.

Understanding how all of these subsystems work is what helps scientists determine how subsystems respond to change. Oregon is a diverse place with regards to climate. The purpose of this lab is study the climate of Oregon and to focus on the major influences on Oregon's varied climate.

Goals and Objectives

- Interpret climatic data from maps, tables, and graphs
- Describe Oregon's climate based on climatic data
- Develop an understanding of the major factors influencing Oregon's climate

Useful Websites

- http://weather.noaa.gov/weather/OR_cc_us.html
- http://www.wrcc.dri.edu/CLIMATEDATA.html
- http://www.oregonphotos.com/pagetwentyone-Q.html
- http://www.worldbook.com/wb/Students?content_spotlight/climates/north_american_climate_oregon
- http://www.musc.edu/cando/geocam/atacama/atacama.html
- http://www.esa.int/esaEO/SEM3PIWJD1E_index_0.html
- **http://www.wou.edu/las/physci/taylor/gs106/OregonRoadTrip.htm**

Name_____
Lab Day/Time_____

Pre-lab Questions – Complete these questions before coming to lab.

1. Define the following terms:

   A. Orographic lifting

   B. Rain shadow

   C. Jet Stream

2. What is the effect of proximity to a major body of water (like the Pacific Ocean) on climate? How does this relate to the amount of heat that water must absorb to change its temperature?

3. What happens to the temperature of an air mass as it rises? Why?

4. What happens to the relative humidity of an air mass as it rises? Why?

See “Jump Start Activity” on next page to get a jump start on your work.

Laboratory Jump Start Activity

Work in groups to complete the table below by filling in the blanks. Imagine, in your mind's eye, a road trip from Newport, OR to Corvallis, OR to Sweet Home, OR to Santiam Pass, OR to Bend, OR to Burns, OR to Boise, ID. Describe what type of weather and vegetation you would experience on your drive **during the winter months**, for example over Christmas Break. For weather descriptions, your options are: "rainy", "snowy", "sunny and clear", and temperatures can be "above freezing", or "below freezing". For vegetation descriptions, your options are Spruce-Douglas Fir, Ponderosa Pine, agricultural fields (e.g. grass seed, wheat, etc.), Juniper-sagebrush, and sagebrush.

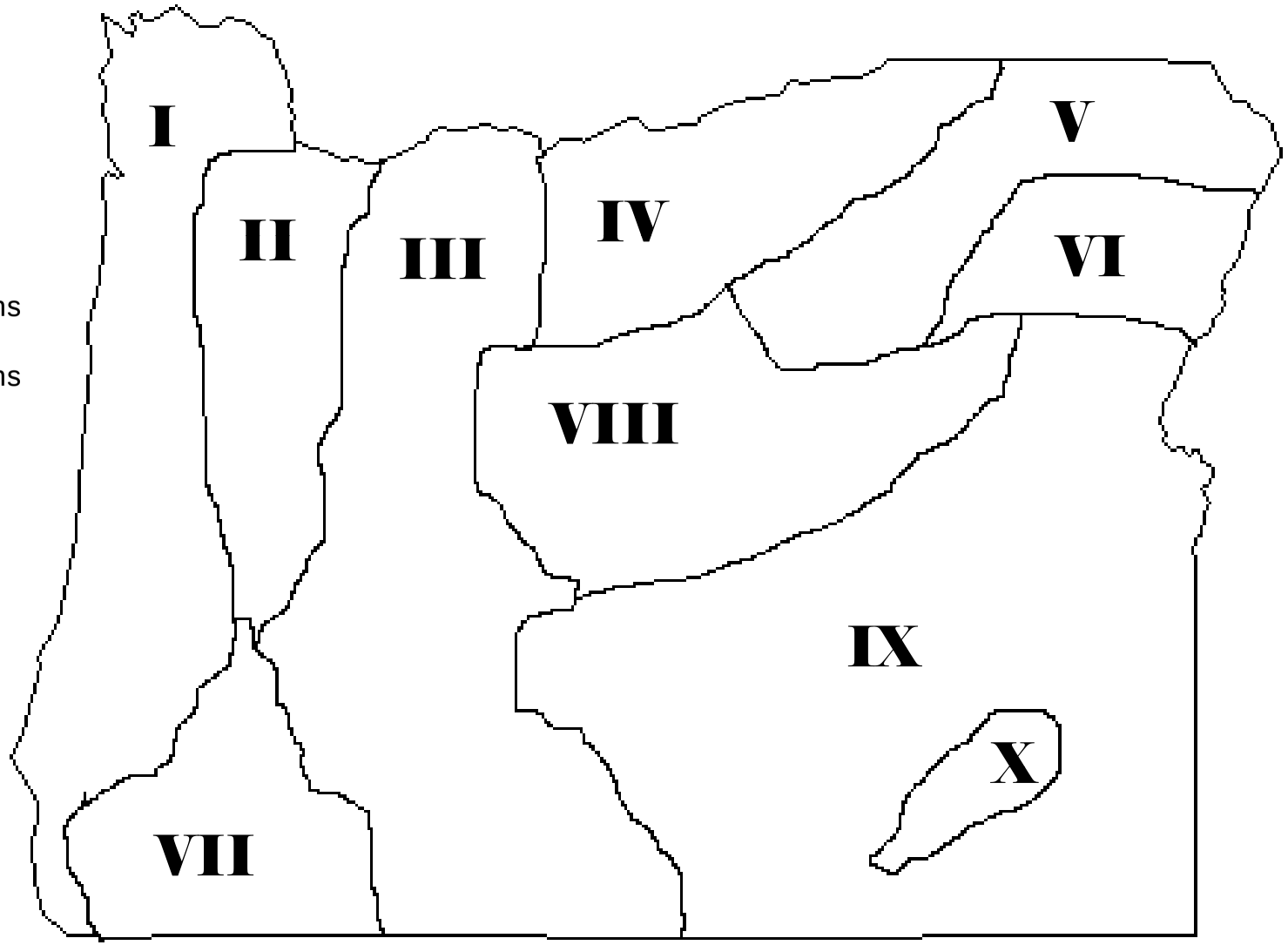
See http://www.wou.edu/las/physci/taylor/gs106/OregonRoadTrip.htm in 'useful websites' if you are unfamiliar with Oregon. Look at the graphs of climate data to fill in the weather and temperature.

Location (as you drive from west to east)	**Weather and temperature**	**Vegetation**
Newport		
Corvallis		
Sweet Home		
Santiam Pass		
Bend		
Burns		
Boise		

In the space below, write a brief paragraph discussing what you think the controlling factors are on the weather and vegetation observations that you've made on your road trip. (Describe what makes the weather like it is in the various places.)

Activity 1: Physiographic Provinces of Oregon

Provinces
Basin and Range
Blue Mountains
Cascade Range
Coast Range
Columbia Basin
High Plains
Klamath Mountains
Steens Mountains
Wallowa Mountains
Willamette Valley



http://www.maps-gps-info.com/or.html

Figure 1: Physiographic provinces of Oregon

Part A – Physiography and Precipitation Maps of Oregon

Activity 1: Physiographic Provinces of Oregon

Oregon is divided into several physiographic zones (I through VIII, with subzones) based on topography (landscape configuration), bedrock geology, and climate. These physiographic zones are listed (in alphabetic order) on page 7.4, with the map labeled Activity 1: Physiographic Provinces of Oregon. Using the map and the list, fill in the table below by matching the geography to the listed province. Work in groups.

Province Map Number	Province Name (from list on map)
I	
II	
III	
IV	
V	
VI	
VII	
VIII	
IX	
X	

Activity 2: Classified Precipitation Map of Oregon

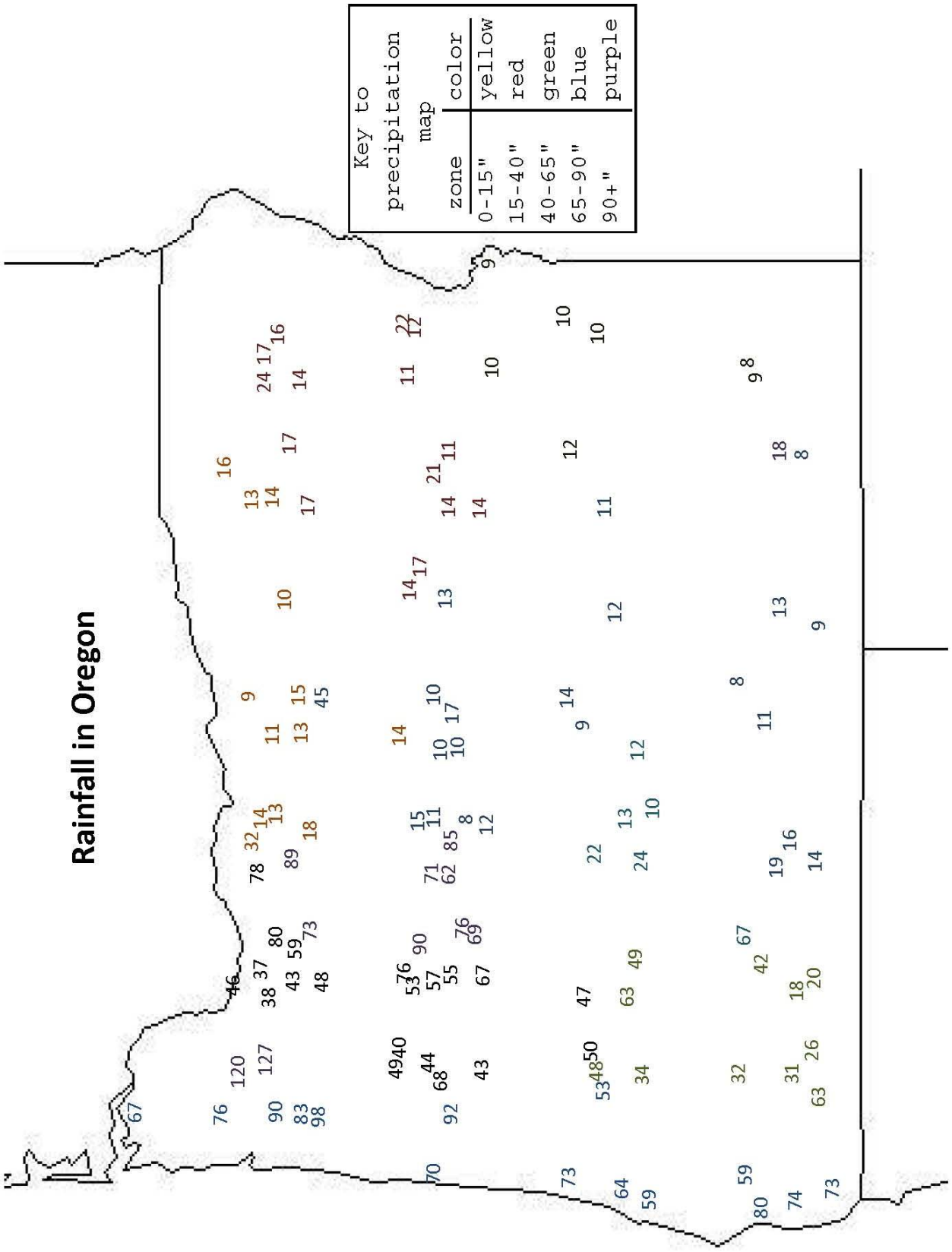
The map labeled "Rainfall in Oregon" shows annual rainfall (in inches/year) for stations in Oregon. Your task is to create a classified precipitation map for Oregon by drawing lines for the precipitation zones noted on the map. Color-code the data into the following annual precipitation zones:

Precipitation Zone	**Map Color**
<15 in/yr	Yellow
15-40 in/yr	Red
40-65 in/yr	Green
65-90 in/yr	Blue
>90 in/yr	Purple

Here's how you do it:

- At each station, read the annual precipitation and color-code each value by using a colored pencil and the zone colors listed above. Do not color the entire map at this time, only color-code the station.
- Now you have the stations color-coded. **Use a regular <u>pencil</u>** to draw map boundary lines between each color-coded interval, separating the stations by color. *NOTE: make sure you interpolate between data points and* ***draw a boundary line for each precipitation zone.*** <u>Don't leave out intervening zones</u> that may not have data points. In other words, have the rainbow of colors between the data points that are not in adjacent zones. Like a staircase, all the steps need to be between higher zones and lower ones. See 'useful websites' for some guidance.
- Color in the entire map, filling in the appropriate color for your boundary lines. Do this quickly, but neatly (don't spend the rest of the period coloring…just get on with it).

Figure 2: Rainfall zones in Oregon



Answer the following questions in the space provided:

1. Compare the Physiographic Map (Part A) to the Precipitation Map (Part B). What inferences can you make with regards to landforms and precipitation in Oregon?

2. Which REGIONS of the state are driest?

3. Which REGIONS of the state are the wettest?

4. Which direction do weather systems come from in Oregon: northerly, southerly, easterly, westerly?

5. How do these weather patterns relate to the precipitation-landscape relationships that you observed above?

6. What does the term "rain shadow" mean?

7. How does it form in Oregon?

8. Which parts of Oregon are in a "rain shadow"?

Part B - Plotting Climate Data on Graphs

Activity 1: Temperature Transect

Table 1 (page 7.10) is a summary of average annual climate data for locations in Oregon. The weather station locations are arranged by region in the state. Station name abbreviations are shown in parentheses (e.g. Corvallis station = CVO). The station locations are shown on below.

Plot a bar graph of temperature across Oregon, using data in Table 1. Use the average July High Temperature (degrees F) for the following stations: Newport (ONP), Corvallis (CVO), Santiam Pass (SP), Redmond (RDM), Burns (BNO), and Ontario, (ONO). Use the graph paper on Figure 4: Graph of Temperature Transect Across Oregon (page 7.11). Plot a vertical bar to the temperature shown on the Y-axis at the appropriate position marked on the X-axis. **Do not have the bars touch one another**; they should be narrow bands of equal width.

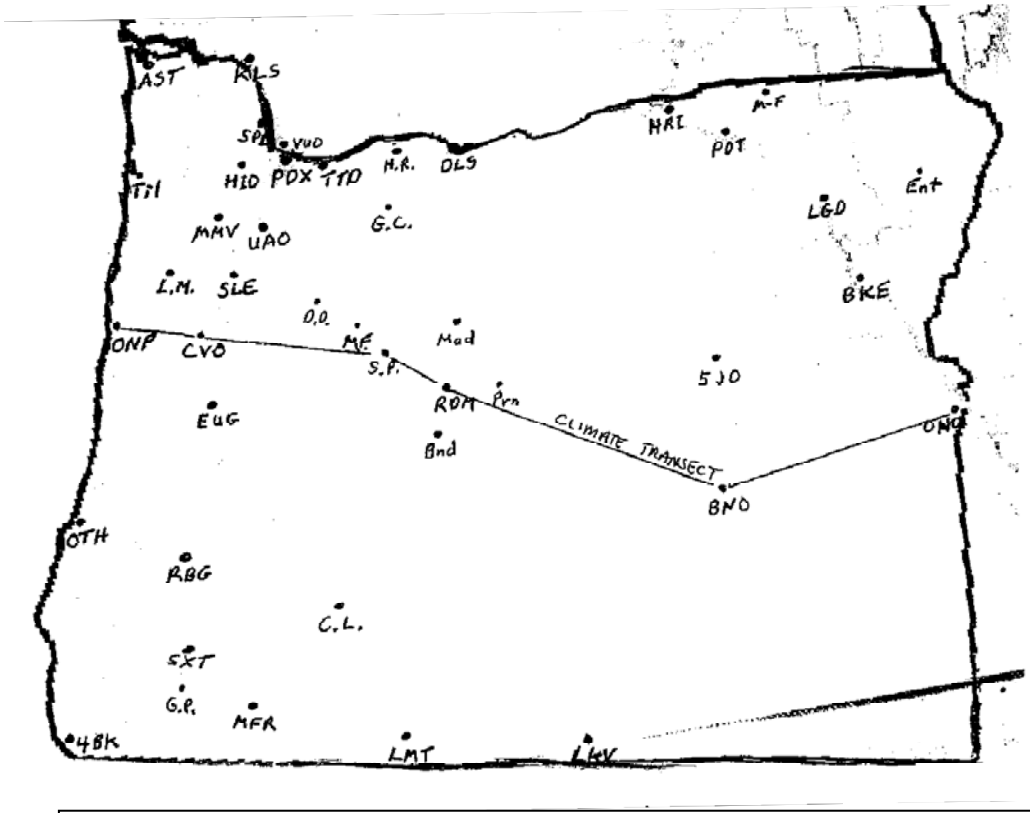


Figure 3: Weather Station Location map for Oregon

OREGON CLIMATE				Mean Annual					
	elev.	Jul Hi	Jan Lo	Temp	Precip	Snow	% Precip		
Location	feet	deg F	deg F	deg F	in.	in.	Nov-Apr	Koeppen's Climate Classification	
Coast									
Astoria (AST)	10	68	36	51	66	5	75%	Csb	*1st Letter*
Tillamook	10	67	36	50	89	3	75%	Cfb	A: Humid tropical
Newport (ONP)	140	65	37	50	72	2	76%	Csb	B: Dry
North Bend (OTH)	10	66	39	53	63	2	81%	Csb	C: Moist with mild winters
Brookings (4BK)	50	68	41	54	75	-	79%	Csb	D: Moist with cold winters
Coast Range									E: Polar climates
Laurel Mountain	3590	64	30	44	112	110	75%	Csb	
Willamette Valley									*2nd Letter*
Portland (PDX)	30	80	34	54	36	5	73%	Csb	S: Semi-arid
Hillsboro (HIO)	160	80	33	52	38	5	76%	Csb	W: Arid
McMinnville (MMV)	150	82	34	52	42	5	78%	Csb	w: dry winters
Salem (SLE)	200	82	33	52	39	6	77%	Csb	s: dry summers
Corvallis (CVO)	190	80	33	52	43	6	78%	Csb	f: Wet all seasons
Eugene (EUG)	360	82	34	53	49	6	79%	Csb	
Southwestern Valleys									*3rd Letter*
Roseburg (RBG)	510	84	35	54	32	4	78%	Csb	h: Hot and dry
Grants Pass	920	90	33	55	31	5	81%	Csa	k: Cool and dry
Medford (MFR)	1300	91	30	54	19	8	75%	Csa	a: Summers long and hot
Klamath Mountains									b: Summers long and cool
Sexton Summit (SXT)	3840	75	31	48	37	97	76%	Csb	c: summers short and cool
Cascades									
Government Camp	3980	68	24	42	86	278	76%	Dsb	
Detroit Dam	1220	77	33	51	87	18	76%	Csb	
Marion Forks	2480	80	26	46	68	112	77%	Csb	
Santiam Pass (SP)	4750	73	21	40	87	437	77%	Dsc	
Crater Lake	6470	68	18	38	66	495	78%	Dsc	
North Central									
Hood River	500	80	28	51	31	36	80%	Csb	
The Dalles (DLS)	100	88	30	55	14	12	79%	Csa	
Hermiston (HRI)	620	88	26	53	9	8	69%	BSk	
Pendleton (PDT)	1480	88	27	52	12	17	67%	BSk	
Milton-Freewater	970	89	28	54	14	12	64%	BSk	
South Central									
Madras	2230	87	23	49	11	12	62%	BSk	
Redmond (RDM)	3060	85	22	47	9	20	60%	BSk	
Prineville	2840	87	22	48	10	12	62%	BSk	
Bend	3660	82	22	46	12	35	67%	BSk	
Klamath Falls (LMT)	4090	85	20	48	13	35	70%	Dsb	
Burns (BNO)	4140	84	13	43	13	42	57%	Dfb	
Lakeview (LKV)	4780	84	19	46	16	65	66%	Dsb	
Northeast									
LaGrande (LGD)	2750	86	24	49	17	30	58%	Dsb	
Enterprise	3880	78	12	41	16	53	50%	Dfb	
John Day (5JO)	3060	88	21	49	13	24	54%	Dfb	
Baker City (BKE)	3370	85	17	46	11	25	57%	Dfb	
Southeast									
Ontario (ONO)	2140	96	19	52	10	18	67%	BSk	

South-Central Oregon data

Table 1: Mean Annual Climate Summary for Oregon

Questions:

1. What do you observe about the July temperature patterns when comparing Newport to Burns and Ontario, Oregon? What physical mechanisms in the atmosphere may account for this relationship?

2. What do you observe about the July temperature patterns when comparing Santiam Pass to Burns and Ontario, Oregon? What physical mechanisms in the atmosphere may account for this relationship?

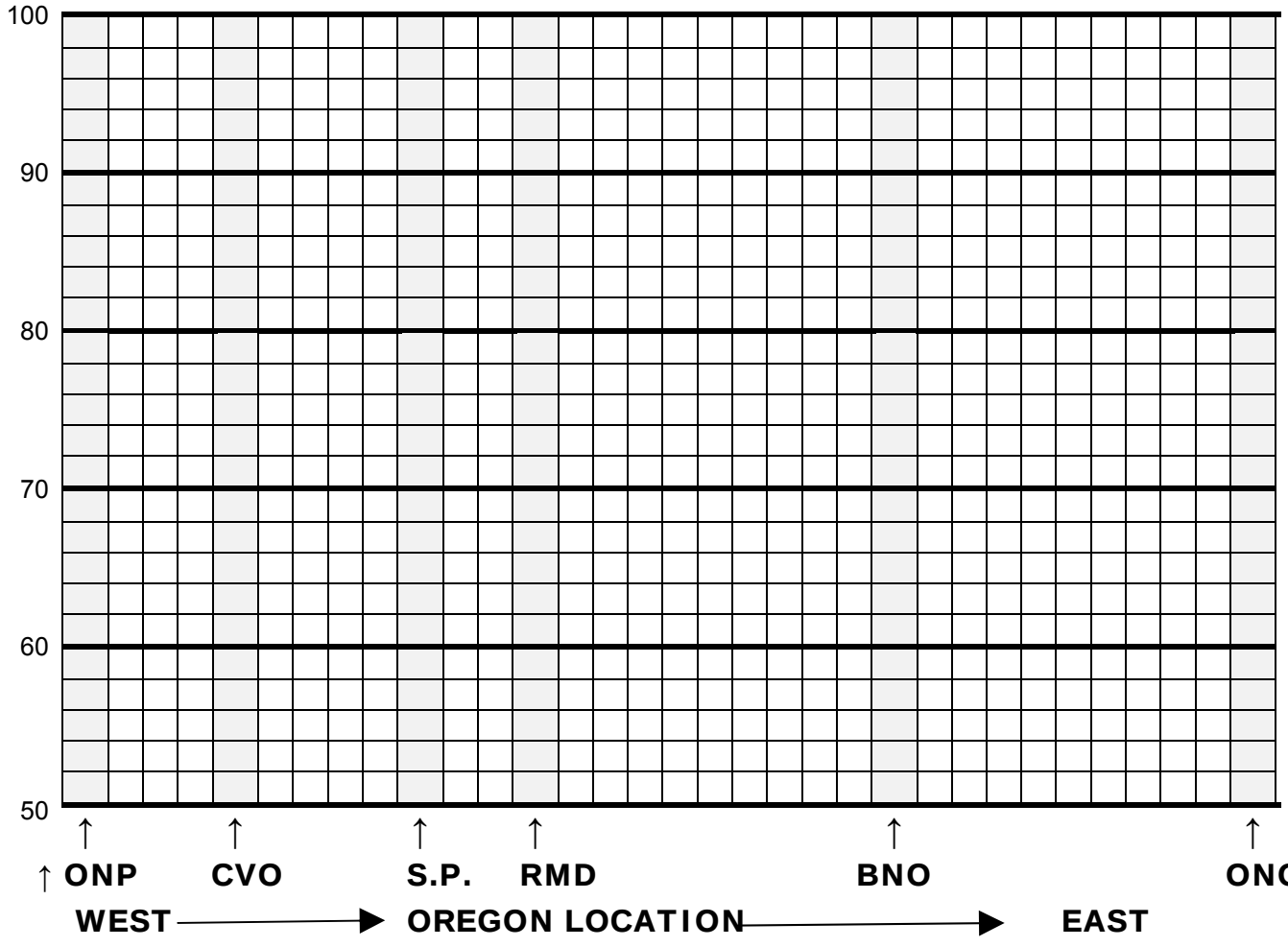


Figure 4: Bar Graph of Temperature Transect Across Oregon

Based on your precipitation data (Part A) and temperature data (Part B), *intuitively decide*, which parts of the state would you classify as "Maritime" and which parts would you classify as "Continental".

Intuitive Answer Here:

Based on your observations and intuitive answer, describe the terms maritime and continental in terms of seasonal temperature and precipitation by filling in the table below. (Use Table 1 to support your descriptions.)

	Maritime	Continental
Summer Temperatures (Hot or Cool?)		
Winter Temperatures (Moderate or Extreme)		
Summer Precipitation (Dry or Wet?)		
Winter Precipitation (Dry or Wet?)		

Activity 2: Focus on South-Central Oregon.

Make some scatter plots to examine the annual climate data in Table 1 for the South Central Oregon section (stations include Madras, Redmond, Prineville, Bend, Klamath Falls, Burns, and Lakeview). Use the data for the listed weather stations to make scatter plots on the graphs provided for:

- Mean Annual Precipitation vs. Elevation (Figure 5a)
- Mean Annual Temperature vs. Elevation (Figure 5b)
- Mean Annual Temperature vs. Mean Annual Precipitation (Figure 5c)

The graphs have already been scaled for you. Plot a point for each south-central weather station on each graph. Label the point with the name of the station. Or you can enter the data in a spreadsheet program, and use its chart function to make the graphs.

Mean Annual Precipitation vs. Elevation
South-Central Oregon

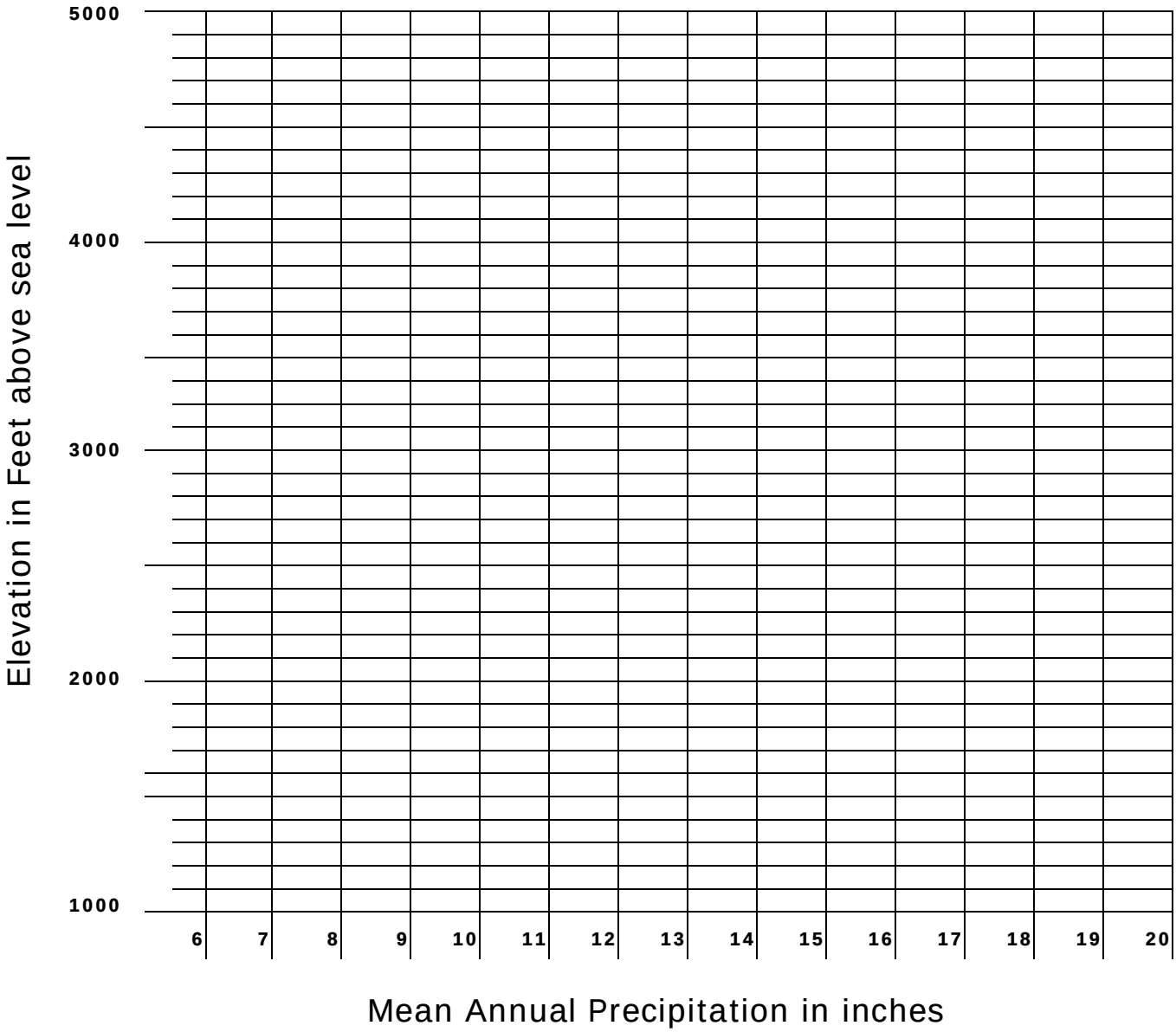


Figure 5a: Plot of Precipitation vs. Elevation—South-Central Oregon

Mean Annual Temperature vs. Elevation
South Central Oregon

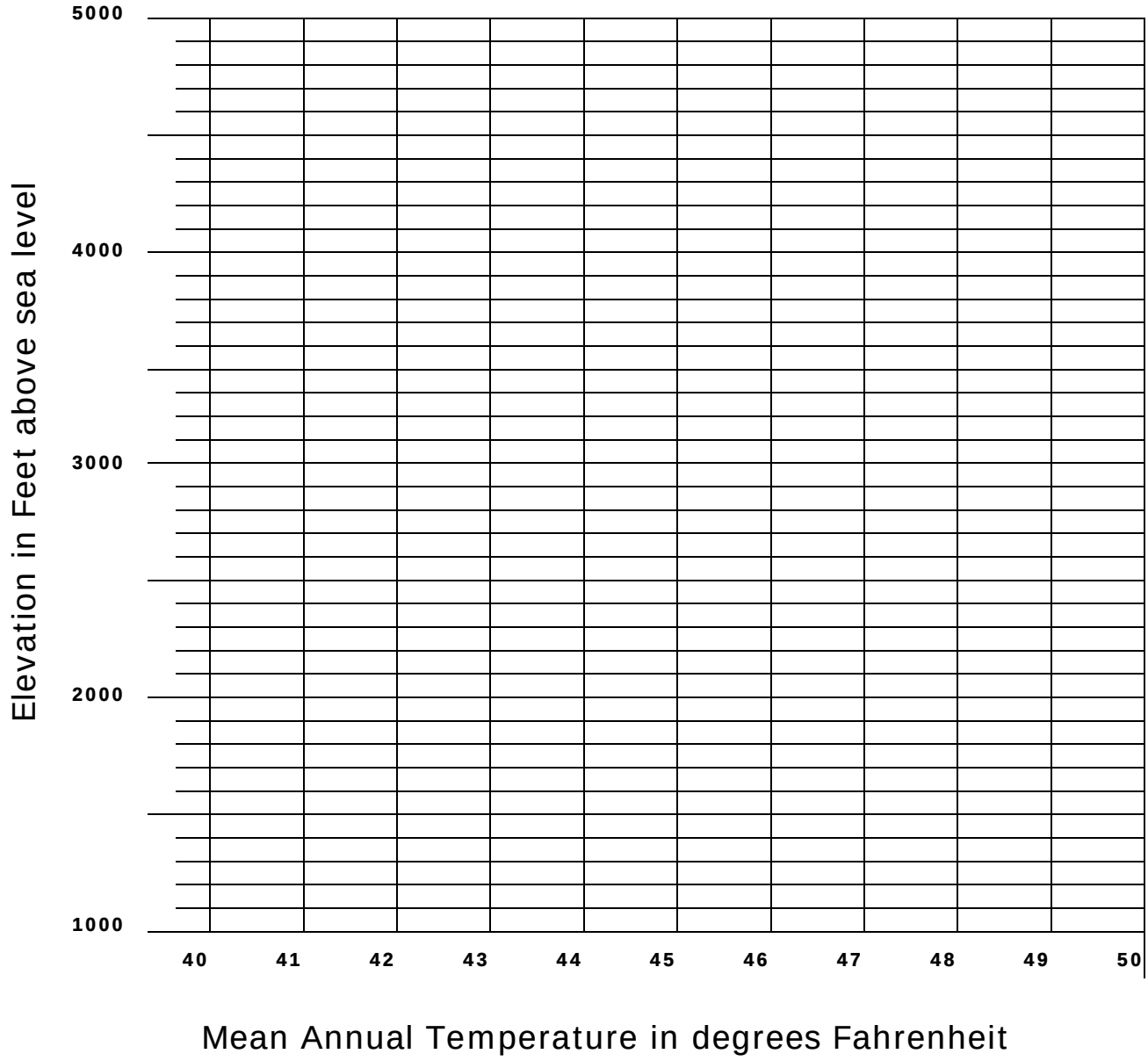


Figure 5b: Plot of Mean annual Temperature vs. Elevation —South-Central Oregon

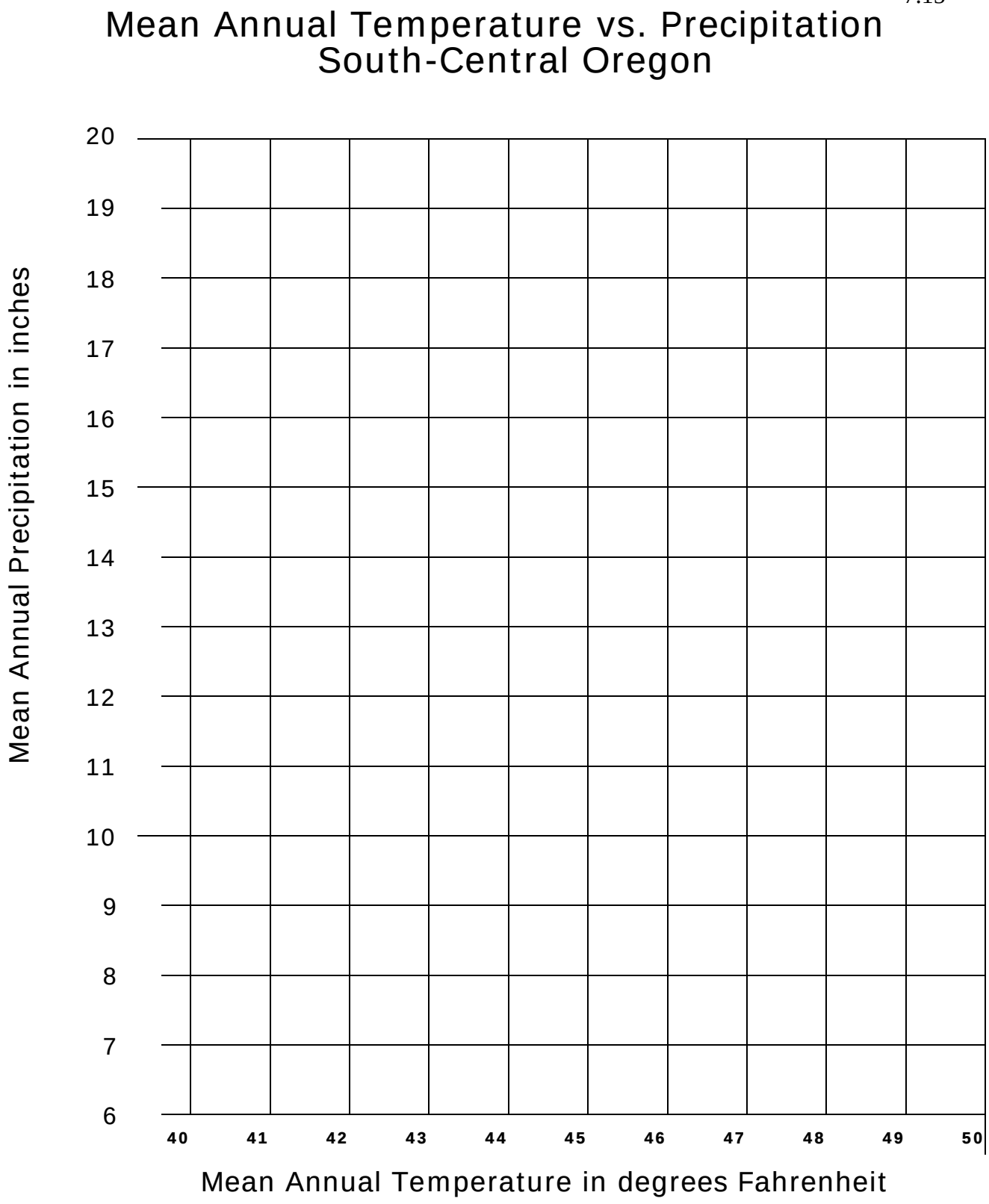


Figure 5c: Plot of Mean Annual Temperature vs. Precipitation —South-Central Oregon

Questions

1. Does precipitation relate to elevation in south-central Oregon? (That is, how consistent is the relationship in your data set: good fit, moderate fit, or poor fit?) Draw a 'best fit' line **if** there seems to be a correlation. **Do not draw a "best-fit" line if the data points are scattered in a "shot-gun" pattern.** (The shotgun pattern indicates little relationship between the two parameters).

2. Does mean annual temperature relate to elevation in south-central Oregon? That is, how consistent is the relationship in your data set: good fit, moderate fit, or poor fit?) Is the data relationship as convincing as the Precipitation-Elevation data?

3. Does mean annual precipitation relate to temperature in south-central Oregon? (How consistent is the relationship given your data set: good fit, moderate fit, or poor fit?)

4. Given last week's concepts of evaporation, forceful lifting, atmospheric elevation, dew point, relative humidity, and precipitation, write a summary paragraph explaining your graph observations in terms of atmospheric physics.

Name_____

Lab Day/Time_____

POST-LAB ASSESSMENT

1. Using what you have learned in lab today, look at the South American continent on a map and explain the existence of the Atacama Desert west of the Andes.

2. Given the location of St. Paul, Minnesota, predict what the general climate conditions should be like for that city. What will the summers be like? What will the winters be like? Justify your answer based on concepts from today's lab.

3. Sometimes, on a partly cloudy day in the Willamette Valley, you will see thick clouds to the west over the coast range. The clouds then seem to thin and break up in the Willamette Valley and then thicken to the east over the Cascades. What effect accounts for this pattern in cloud cover? Explain.