NAME: _____ **PERIOD:** _____ **DATE:** _____

LAB PARTNERS: _____ **LAB #31**

DRAWING ISOTHERMS & ISOBARS ON A WEATHER MAP

INTRODUCTION

Variables such as temperature, pressure, and wind are plotted on weather maps to determine the particular weather pattern in a particular region. This information gives you the current weather conditions at any given location and can be used to predict incoming weather within an area. Temperature is one of the most important components in predicting weather. To better understand the movement of air masses across a landmass meteorologists connect points of equal temperature (***isotherms***), as well as points of equal atmospheric pressure (***isobars***). Bodies of air with similar characteristics are gathered from a starting location and move within a band of air known as a planetary wind belt. Air masses are described based on their temperature and humidity.

Standard:

HS-ESS2-8

Evaluate data and communicate information to explain how the movement and interactions of air masses result in changes in weather conditions.

MATERIALS

Weather Maps
Map of the USA
Calculator
Pencil
Colored Pencils (dark and light blue, dark and light green, yellow, orange, light and dark red)

VOCABULARY

a) Isotherms: _____

b) Isobars: _____

c) Barometric Pressure: _____

d) Air mass: _____

e) Source Region: _____

f) Continental Polar: _____

g) Continental Tropical: _____

h) Maritime Polar: _____

i) Maritime Tropical: _____

PART 1

PROCEDURE

1. Using the Temperature Data Table, label the temperature on **Map A** for each city. Be sure to place the value to the upper left of the circle WITHOUT units!

   EX: 

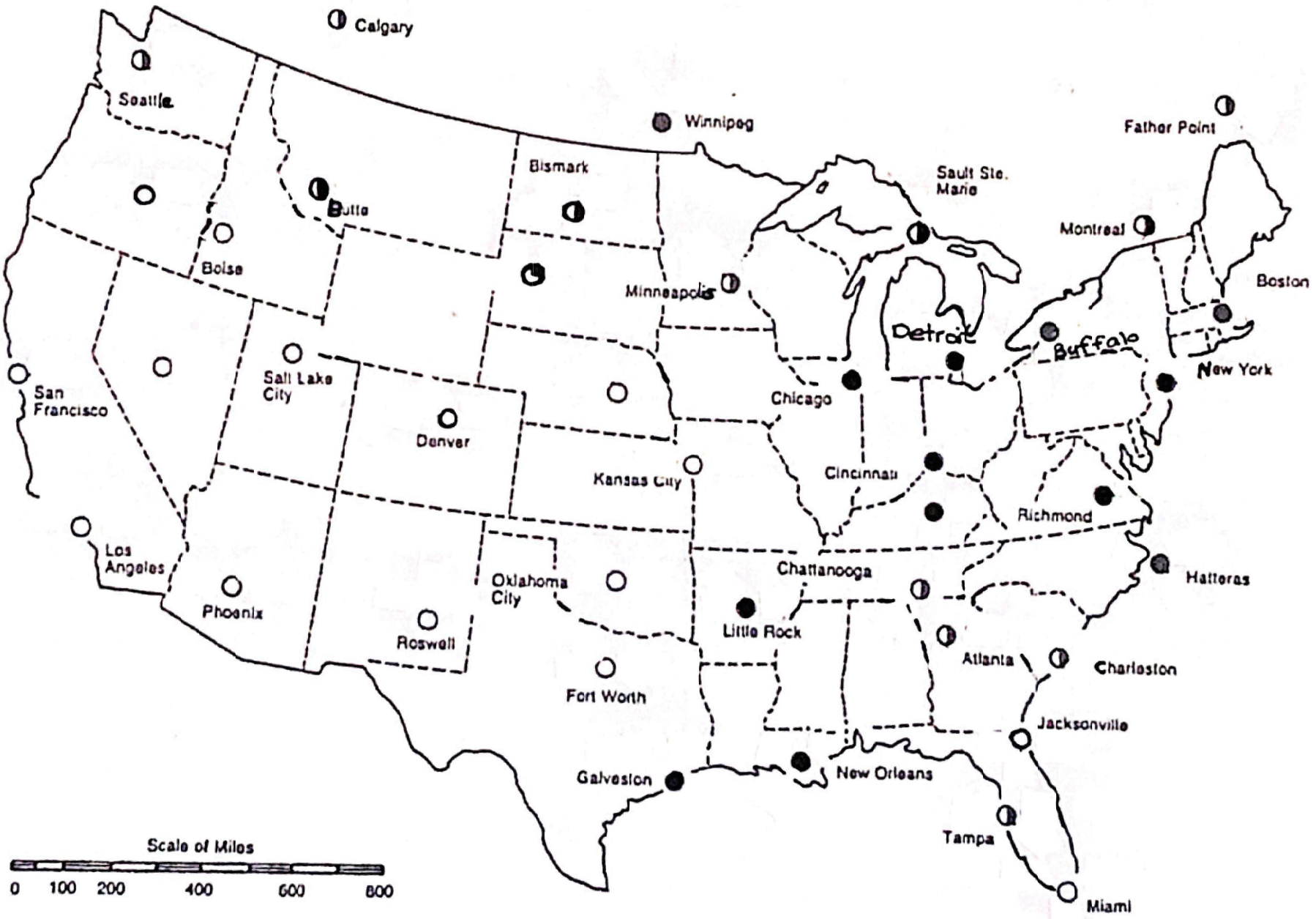
2. On **Map A** use a pencil to draw isolines using a ten-degree interval. Be sure to ***extend*** *all lines* ***off*** *the map*.
3. Color the zones in between the isotherm lines using the following color code:

21 - 29	Purple	61 – 69	Light Green
31 – 39	Dark Blue	71 – 79	Yellow
41 – 49	Light Blue	81 – 89	Orange
51 - 59	Dark Green	91 +	Light Red

TEMPERATURE DATA TABLE

City	Temp. (°F)	City	Temp. (°F)	City	Temp. (°F)
Calgary	30	Galveston	80	Miami	90
Seattle	40	Fort Worth	75	Tampa	87
Boise	49	Oklahoma City	66	Jacksonville	80
San Francisco	60	Kansas City	50	Charleston	73
Los Angeles	62	Minneapolis	32	Atlanta	78
Phoenix	73	Sault Ste. Marie	33	Hatteras	69
Salt Lake City	57	Detroit	44	Richmond	48
Butte	40	Chicago	41	New York	45
Winnipeg	27	Cincinnati	60	Boston	37
Bismark	30	Chattanooga	70	Buffalo	40
Denver	54	Little Rock	72	Montreal	30
Roswell	70	New Orleans	80	Father Point	30

MAP *A*


Calgary
Seattle
Winnipeg
Father Point
Bismark
Sault Ste. Marie
Butte
Montreal
Boise
Minneapolis
Boston
Detroit
Buffalo
New York
San Francisco
Salt Lake City
Chicago
Denver
Cincinnati
Kansas City
Richmond
Los Angeles
Chattanooga
Hatteras
Oklahoma City
Phoenix
Roswell
Little Rock
Atlanta
Charleston
Fort Worth
Jacksonville
Galveston
New Orleans
Tampa
Miami
Scale of Miles
0 100 200 400 600 800

Map Analysis

1. Describe the general appearance of the isolines on ***Map A***. _____

   _____

2. How does the temperature change from north to south? Why do you think this is?

   _____

   _____

   _____

3. Based on the temperature readings for this map, what season do you think is represented. Explain your reasoning.

   _____

   _____

   _____

4. Near which cities is the temperature gradient the greatest? Justify your answer.

   _____

   _____

5. Calculate the ***temperature gradient*** between **Little Rock** and **Richmond**. Write your answer to the nearest hundredth with correct units.

   Final Answer: _____

6. How would having more information change weather forecasts at the time this map was constructed?

   _____

   _____

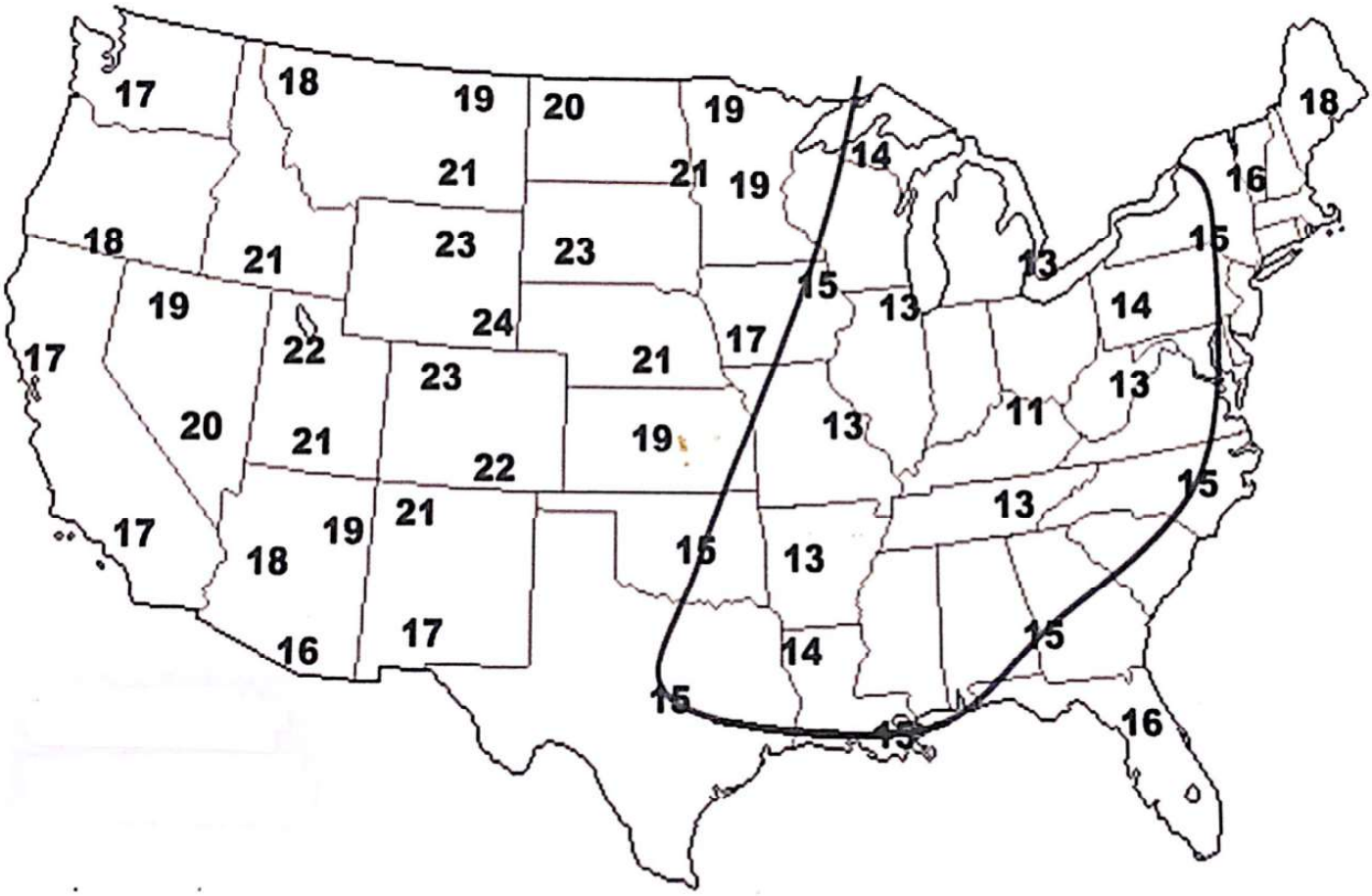
PART 2

PROCEDURE

1. Using a two-degree interval draw in the isotherms for **Map B**, for odd numbers starting with 11°. Be sure to ***extend*** *all lines* ***off*** *the map*, when applicable. ***Some*** isolines are closed *loops/circles*. The 15° line has been drawn for you.
   Note: You *may* need to *estimate the values* in some locations where temperature is not given.
2. Label each isotherm with the correct temperature value.
3. Color the zones in between the isotherm lines using the following color code:

11 – 12	Purple	19 – 20	Light Green
13 – 14	Dark Blue	21 – 22	Yellow
15 – 16	Light Blue	23 – 24	Orange
17 - 18	Dark Green		

MAP ***B***



Map Analysis

1. If more information was given for the Canadian region near the Great Lakes, describe how the 15° isoline might look differently. _____

   _____

2. State ***the lowest*** temperature found ***inside*** the smallest closed loop in the ***eastern*** half of the map. _____

3. State ***the highest*** temperature found ***inside*** the smallest closed loop in the ***western*** half of the map. ____

4. Where is the temperature gradient the least on ***Map B***?

   The closed loops show where the air masses are located. Cold air masses have isotherms that decrease in temperature as you move towards the center, and vice versa for warm air masses. *Reminder: Air masses are described based on their temperature and humidity.*

   USE A MAP OF THE UNITED STATES TO ANSWER THE NEXT TWO QUESTIONS.
   - ***Name the part of the state near the center.***

5. Where is the center of the cold air mass? _____

6. Where is the center of the warm air mass? _____

7. How would you describe the air mass in the western United States compared to the eastern United States? (Note the location over land for the two centers). Justify your answer.

   _____

   _____

8. Compare ***Map A*** and ***Map B***, describe ***two differences*** between the two maps.

   _____

   _____

   _____

   _____

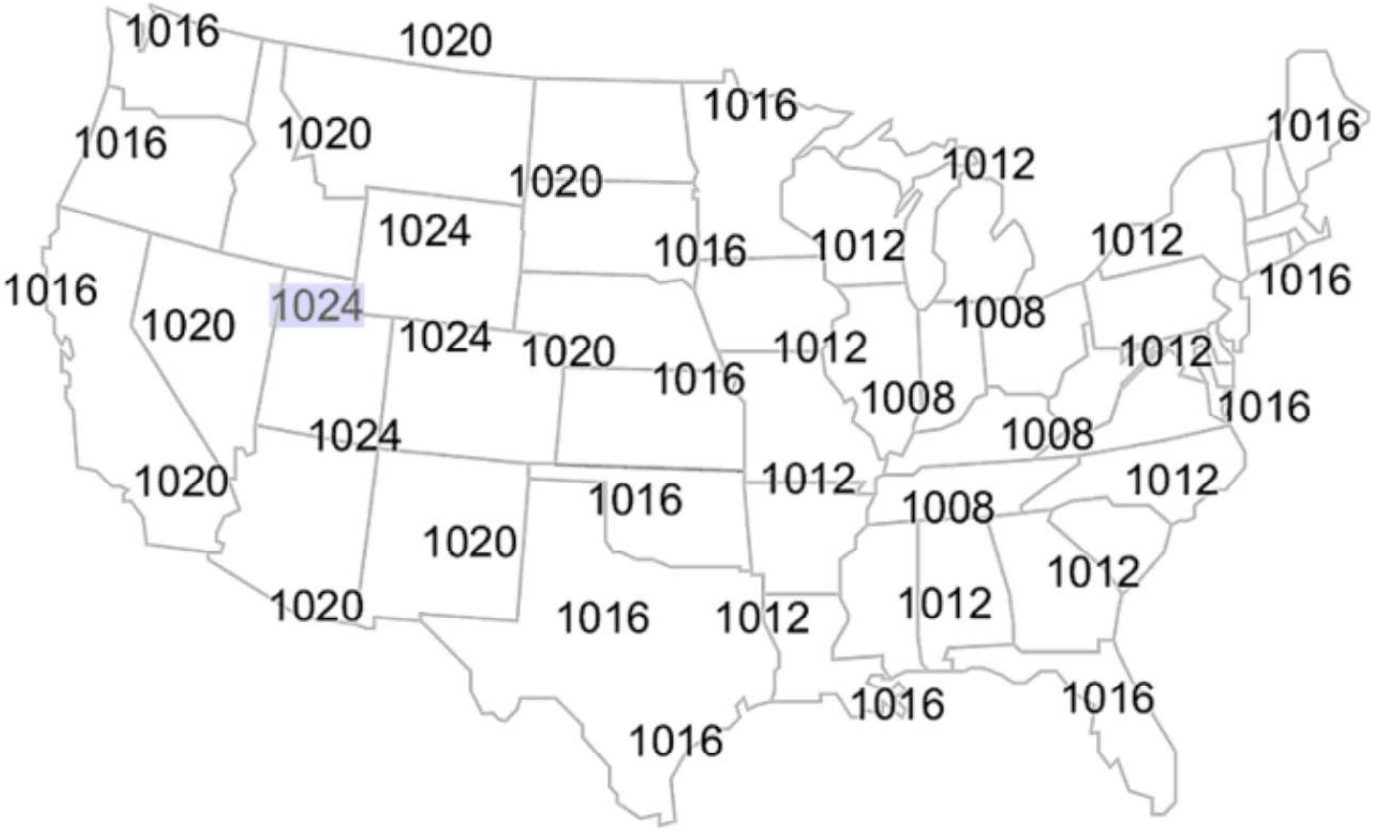
PART 3

A visual representation of ***atmospheric pressure*** is constructed on a weather map using isobars. The numbers on the map are written in ***millibars***.

PROCEDURE

- Draw a smooth, curved line connecting weather stations that have the same pressure.
- A four-millibar interval is standard
- On ***Map C***, draw and label a separate line for 1008, 1012, 1016, 1020, 1024.
  - *There should be TWO lines for 1016!!*
- Label the centers of high and low pressure using a capital H and L, respectively.

MAP *C*



Map Analysis

USE A MAP OF THE UNITED STATES TO ANSWER THE NEXT TWO QUESTIONS.

 Name the part of the state near the center.

1. Identify the location of the high-pressure center. _____

   What is the value at the center of the high pressure? (include units) _____

2. Identify the location of the low-pressure center. _____

   What is the value at the center of the low pressure? (include units) _____

Areas of high pressure are associated with drier conditions as air sinks towards the Earth's surface and moisture evaporates. Comparatively, low pressure systems are typically wetter as they bring precipitation from rising air that cools and condenses to form clouds.

3. Over which state would you expect to see rain or snow? _____

4. Over which state would you expect to see clear skies? _____

5. As you travel from Florida to Colorado what change in pressure would you expect to observe?

_____

_____

6. Where is the pressure gradient the greatest? Justify your answer. _____

_____

7. Wind blows from high pressure to low pressure. The strength, or wind speed, is determined by the pressure gradient. The greater the pressure gradient, the greater the wind speed. Therefore, based on what you know about isolines in general, ***how*** could you ***identify*** the ***greatest wind speeds on*** a weather ***map***?

_____

_____8.

8. **Complete this question ON THE MAP**!

   Based on your answer for #5, ***draw a dark arrow*** to indicate the direction the wind is blowing on ***Map C***.

SUMMARY

Using evidence from the lab, how could you use these skills to predict the weather in your area? Explain the importance of weather maps and how many you might need.