# UNIT 6: Weather

# LAB 6-5: WEATHER PATTERNS

**INTRODUCTION:** A basic principle in the Earth sciences is that energy is constantly bringing about changes. In order to understand the changing Earth, we must understand the energy systems at play within the environment which cause those changes.

    The study of energy interactions within the atmosphere leads to the identification of systems that can be mapped as field quantities. A series of composite maps showing these atmospheric variables provides a picture of past and present conditions. Such a composite map is called a **synoptic** map. Weather forecasting is based on a series of synoptic maps.

**OBJECTIVE:** You will construct field maps and learn to identify patterns that can be used to predict weather.

**VOCABULARY:**

synoptic weather map:

isotherm:

barometric (atmospheric) pressure:

isobar:

convergence:
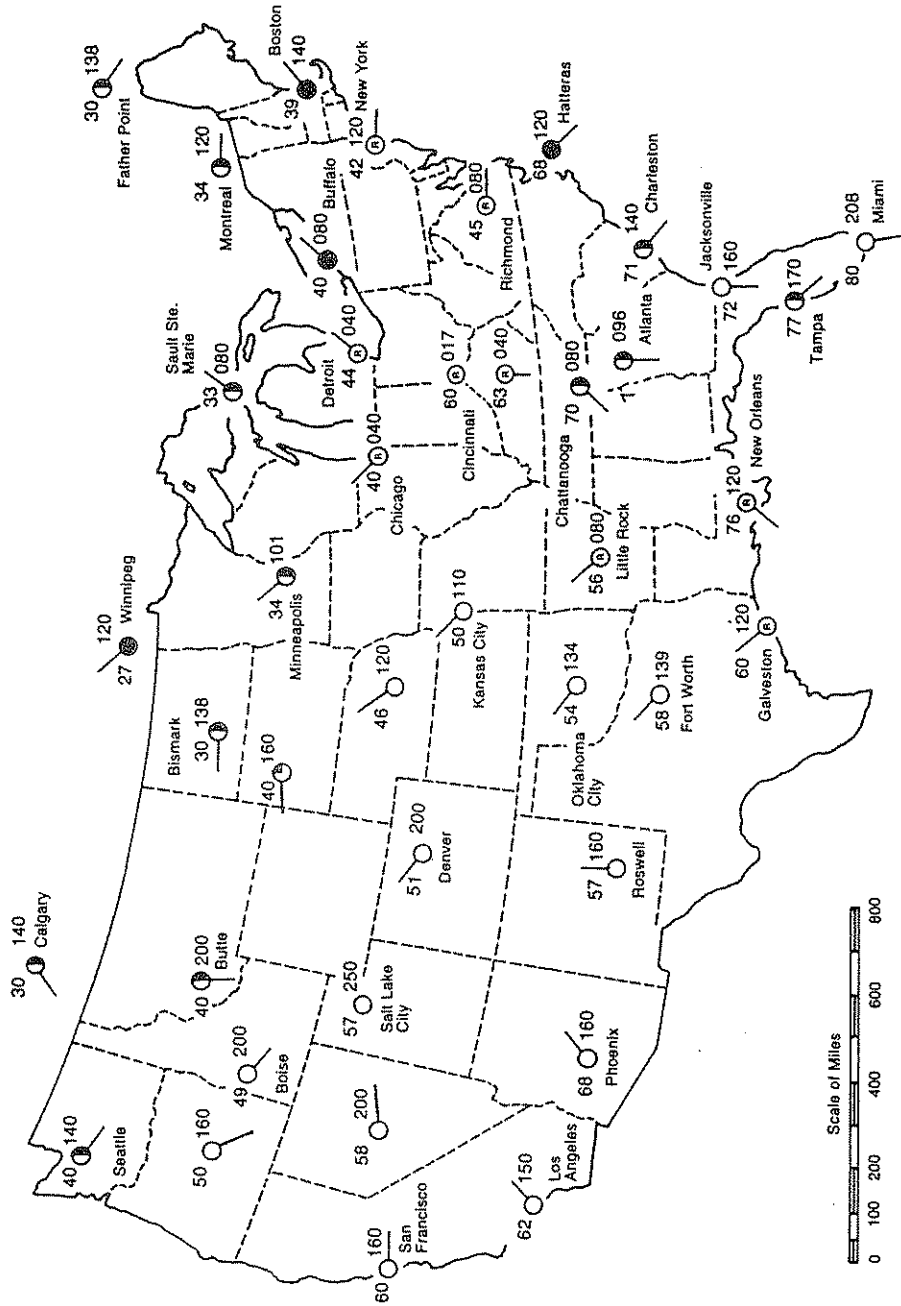
divergence:

cyclone:

anticyclone:

air mass:

source region:

front:

# MAP A: TEMPERATURE PATTERNS



Weather Data Map

## PROCEDURE A:

1. On Map A use a pencil to lightly draw isotherms at 10-degree intervals.
2. Check carefully to be sure that the isotherms are correct, then darken them.

## DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. What is the general appearance of the isotherms on this map?

2. How does the temperature change from north to south on this map?

3. Near which cities is the temperature gradient the greatest?

4. Calculate the temperature gradient between Galveston and Kansas City. SHOW ALL WORK AND LABEL PROPERLY.

5. Calculate the temperature gradient between Cincinnati and Chicago. SHOW ALL WORK AND LABEL PROPERLY.

# MAP B: BAROMETRIC PRESSURE PATTERNS



Weather Data Map

Scale of Miles

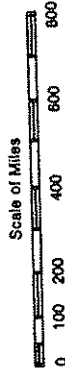0    100   200   400   600   800

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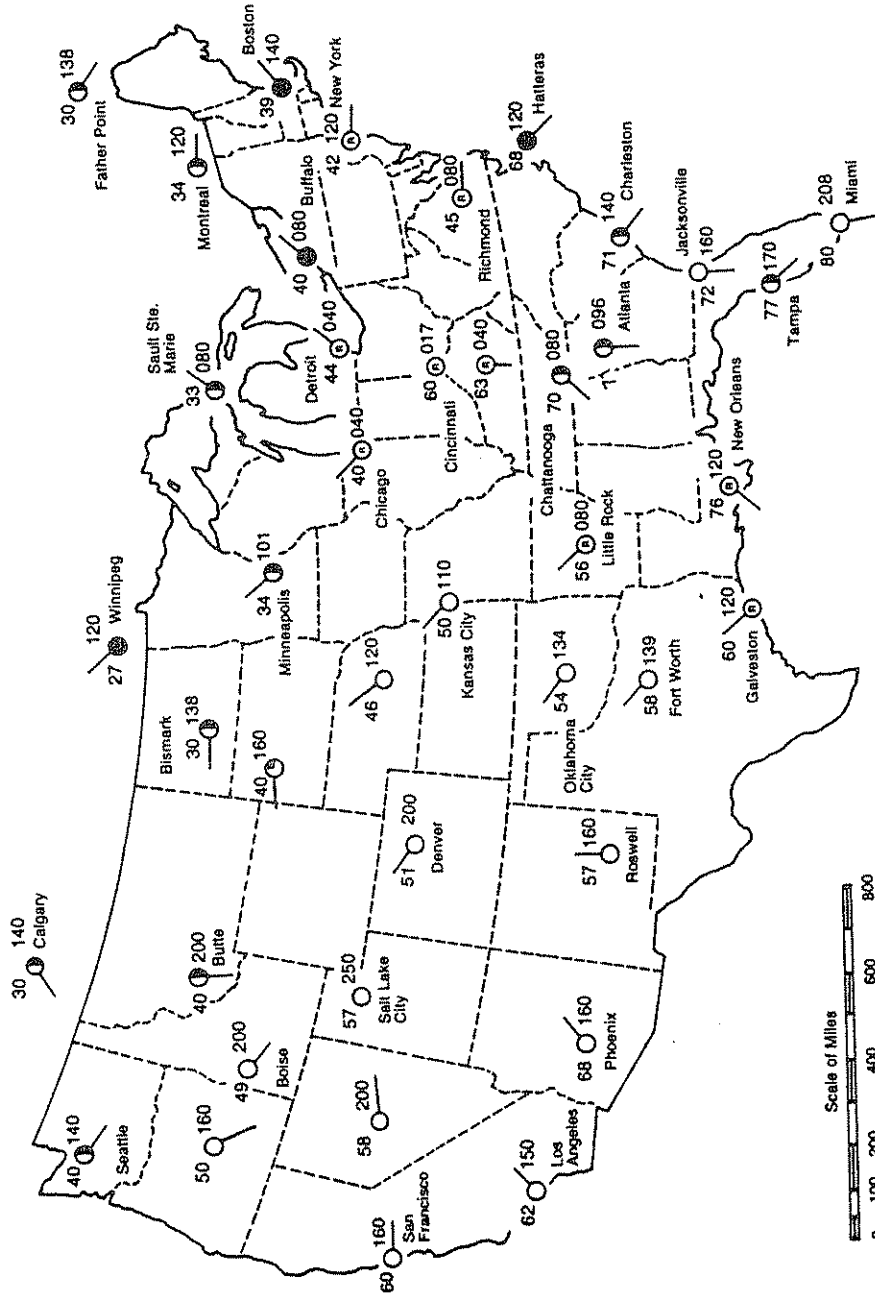
## PROCEDURE B

1. On Map B use a pencil to lightly draw isobars between points of equal atmospheric pressure. Use a 4-millibar interval. Start counting at 1000.0 millibars (000).

2. Check carefully to be sure that the isobars are correct and then darken.

3. Label the centers of high and low pressure areas using a capital H and L respectively.

## DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. What is the general appearance of the isobars on this map?

2. The low pressure center is near which city?

3. The high pressure center is near which city?

4. What is the highest air pressure on the map?

5. What is the highest value for an isobar on Map B?

6. As you travel from Salt Lake City to Los Angeles, what change in atmospheric pressure would you observe?

7. Calculate the pressure gradient between Little Rock and Galveston. SHOW ALL WORK AND LABEL PROPERLY.

# MAP C: SURFACE WIND PATTERNS

Weather Data Map

Father Point 30 138
Boston 40 140
New York 42 120
Montreal 34 120
Buffalo 40 080
Hatteras 68 120
New York ® 42 120
Richmond 45 080
Charleston 71 140
Sault Ste. Marie 33 080
Detroit 44 040
Cincinnati 60 017
63 040
Chattanooga 70 080
Atlanta 71 096
Jacksonville 72 160
Tampa 77 170
Miami 80 208
Chicago 40 040
Little Rock 56 080
New Orleans 76 120
Winnipeg 27 120
Minneapolis 34 101
Kansas City 50 110
Oklahoma City 54 134
Fort Worth 58 139
Galveston 60 120
46 120
Bismark 30 138
40 160
Denver 51 200
Roswell 57 160
Calgary 30 140
Butte 40 200
Salt Lake City 57 250
Phoenix 68 160
Boise 49 200
50 160
Seattle 40 140
58 200
Los Angeles 62 150
San Francisco 60 160

Scale of Miles
0   100   200   400   600   800
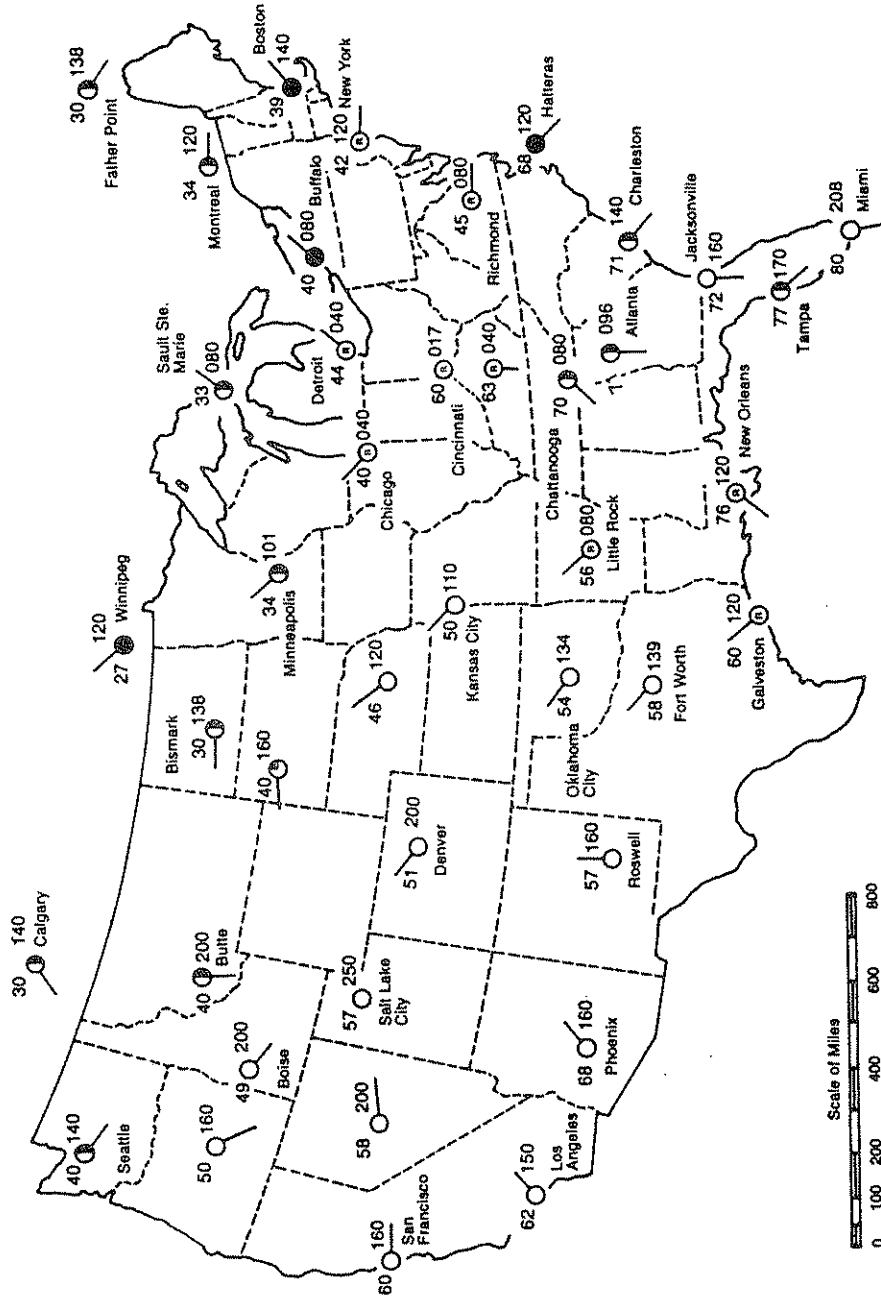
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## PROCEDURE C:

Use Map C.

1. At each station model extend the shaft of the wind arrow through the station model and draw the head of the arrow to show the direction the wind is blowing.

2. Draw larger arrows to show the general pattern of air flow around the high and low pressure centers.

## DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. Where is the greatest change in wind direction in the eastern part of the country?

2. Describe the general surface wind pattern around the low pressure area.

3. Are surface winds around a low pressure area convergent or divergent?

4. Describe the general surface wind pattern around the high pressure area.

5. Are surface winds around a high pressure area convergent or divergent?

# MAP D: PRECIPITATION PATTERNS

Weather Data Map

Father Point 30 138
Boston 39 140
Montreal 34 120
New York 42 120
Buffalo 40 080
Hatteras 68 120
Richmond 45 080
Charleston 71 140
Sault Ste. Marie 33 080
Detroit 44 040
Cincinnati 60 017
63 040
Chattanooga 70 080
Atlanta 096
11
Jacksonville 72 160
Tampa 77 170
Miami 80 208
Chicago 40 040
Little Rock 56 080
New Orleans 76 120
Winnipeg 27 120
Minneapolis 34 101
46 120
Kansas City 50 110
Fort Worth 58 139
Oklahoma City 54 134
Galveston 60 120
Bismark 30 138
40 160
Denver 51 200
Roswell 57 160
Calgary 30 140
Butte 40 200
Salt Lake City 57 250
Boise 49 200
Phoenix 68 160
Seattle 40 140
58 200
50 160
San Francisco 60 160
Los Angeles 62 150

Scale of Miles
0 100 200 400 600 800

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**PROCEDURE D:**

The standard symbol for rain on a weather map is a "dot" (●) below the temperature on a station model. In this exercise an "R" is placed inside the circle to make it less confusing.
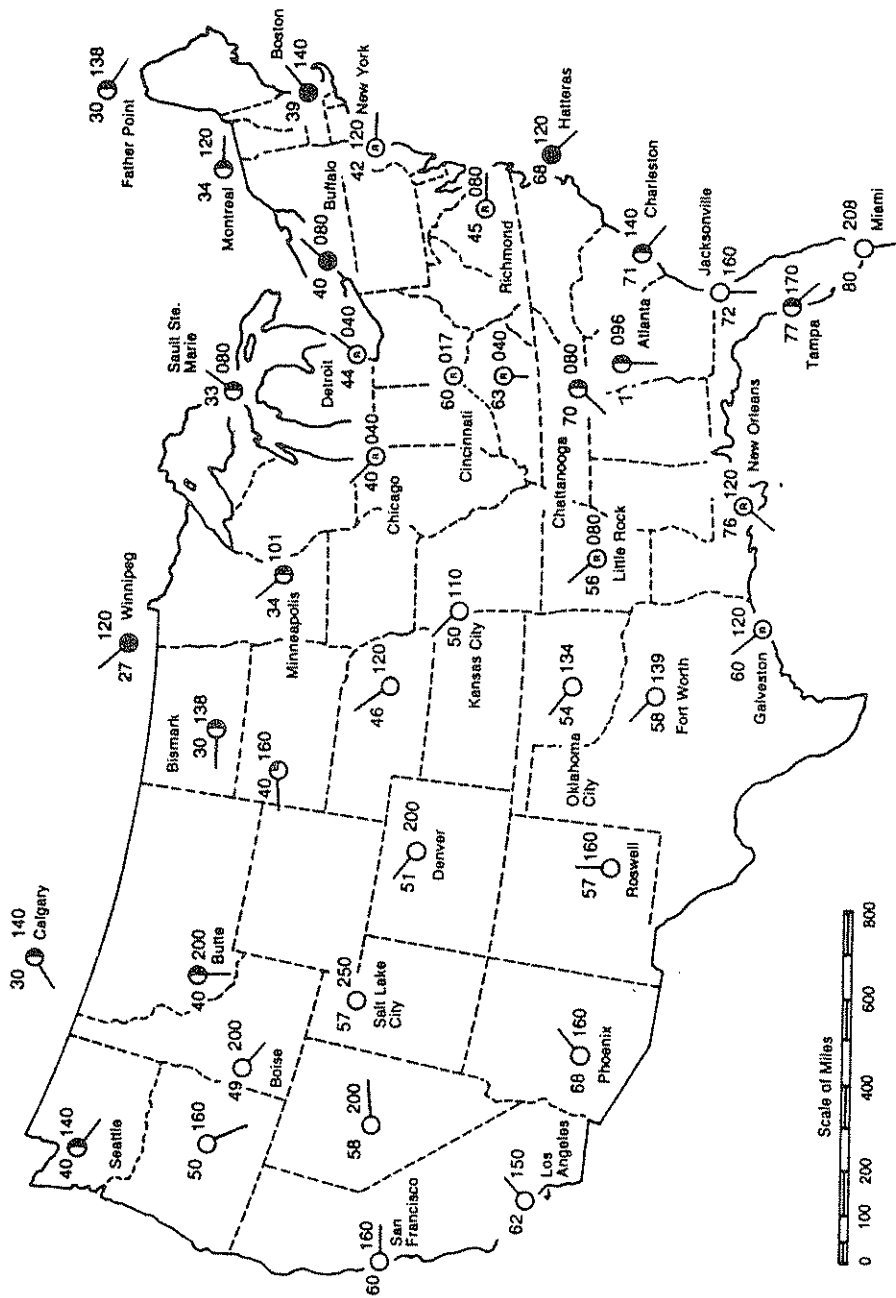
1.  Draw a line around the area on this map where there is precipitation.

2.  Lightly shade in the area where precipitation occurs.

3.  On Map D label the location of the continental polar and the maritime tropical air masses using the appropriate symbols.

**DISCUSSION QUESTIONS:** *(Answer in Complete Sentences)*

1.  Where is precipitation occurring relative to the continental polar and maritime tropical air masses on this map?

2.  Describe, step by step, how clouds form over a low pressure center?

3.  Compared to areas of low pressure, why do areas of high pressure have fewer clouds?

# MAP E: SYNOPTIC WEATHER MAP

Weather Data Map

30 138 Father Point
30 140 Boston
39 New York
34 120 Montreal
42 120 Buffalo
40 080 Buffalo
40 040
68 120 Hatteres
45 080 Richmond
33 080 Sault Ste. Marie
44 Detroit
60 017 Cincinnati
63 040
1. 096 Atlanta
71 Charleston
140 Charleston
72 160 Jacksonville
77 170 Tampa
80 208 Miami
40 040 Chicago
70 080 Chattanooga
56 080 Little Rock
76 120 New Orleans
27 120 Winnipeg
34 101 Minneapolis
50 110 Kansas City
60 120 Galveston
30 138 Bismark
46 120
54 134 Oklahoma City
58 139 Fort Worth
40 160
30 140 Calgary
51 200 Denver
57 160 Roswell
40 200 Butte
57 250 Salt Lake City
68 160 Phoenix
49 200 Boise
50 160
58 200
40 140 Seattle
62 150 Los Angeles
60 160 San Francisco

Scale of Miles

0   100   200   400   600   800

250

## PROCEDURE E:

1. Refer to maps B, C and D and draw isobars, wind patterns, and the area of precipitation on Map E.

2. Using that information, draw in the cold and warm fronts with the proper symbols.

## DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. With respect to the cold front, where does precipitation occur?

2. With respect to the warm front, where does precipitation occur?

3. What are the two characteristics that are used to describe an air mass?

4. Compare the characteristics of an air mass to its source region.

5. Compare the following conditions on either side of the cold front:

   a) temperature:

   b) air pressure:

   c) wind direction:

**CONCLUSION QUESTIONS:**

1. Describe the general weather conditions associated with a high pressure area in terms of:

    a) temperature:

    b) wind patterns

    c) cloud development:

    d) precipitation:

2. Describe the general weather conditions associated with a low pressure center in terms of:

    a) temperature:

    b) wind patterns:

    c) cloud development:

    d) precipitation:

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1. Describe the general weather conditions associated with a high pressure area in terms of: