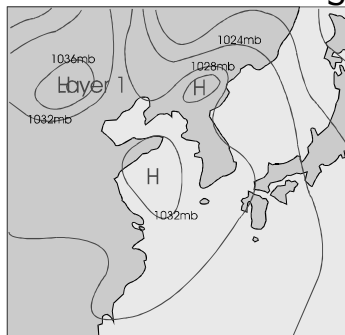Name_____

Section_____

Weather Maps

Lab #_____

Introduction: Air masses are large portions of the atmosphere that share the same properties, such as temperature and humidity. By studying a weather map, you can locate the boundaries of an air mass and find out about its properties. The movements of air masses play a large role in determining the weather over a given area. In this lab, you will construct two different weather maps using three weather variables: air pressure, temperature, and rainfall.

Objectives: Students will be able to construct maps of weather variables and interpret data on weather maps based on the movement of air masses.
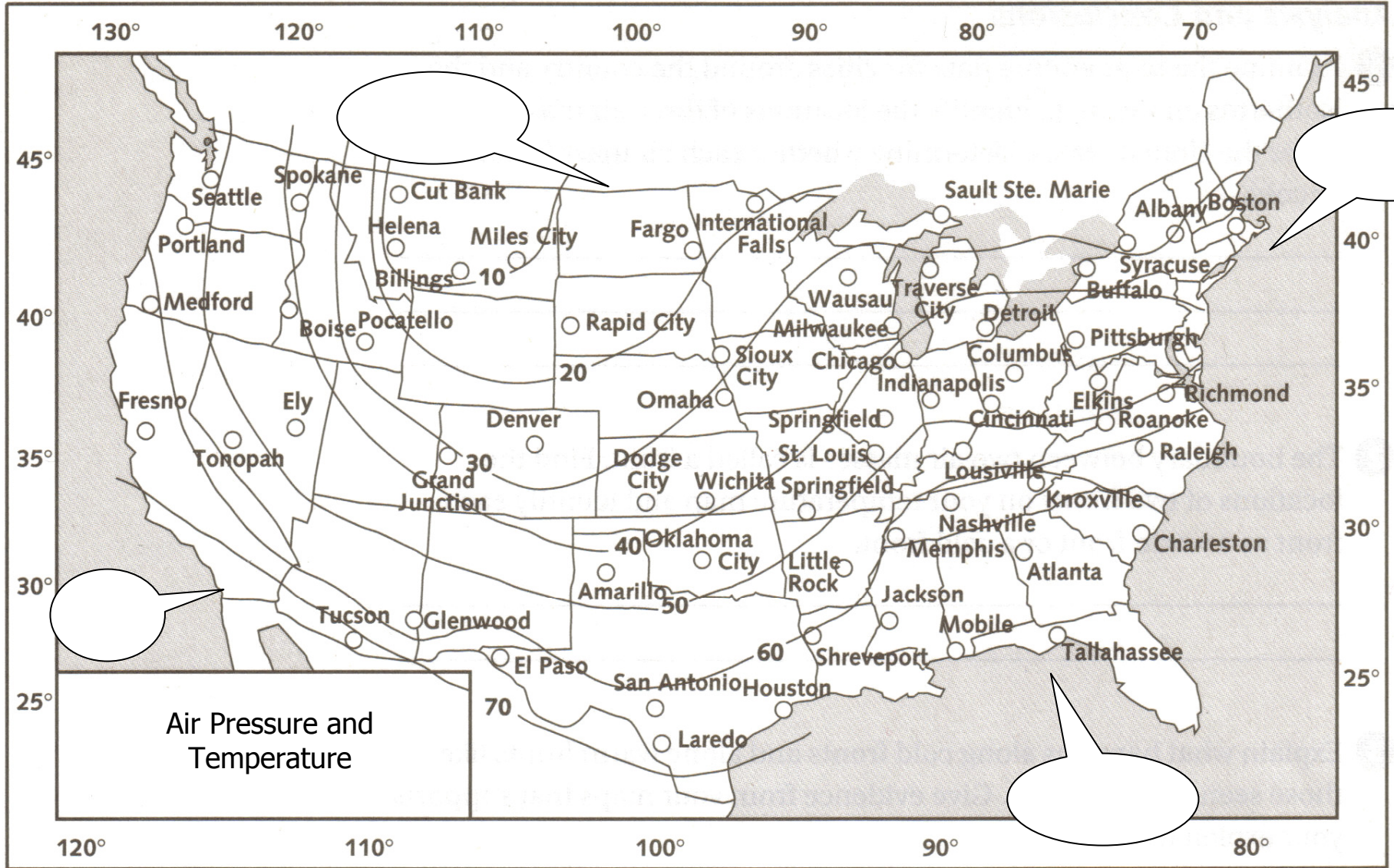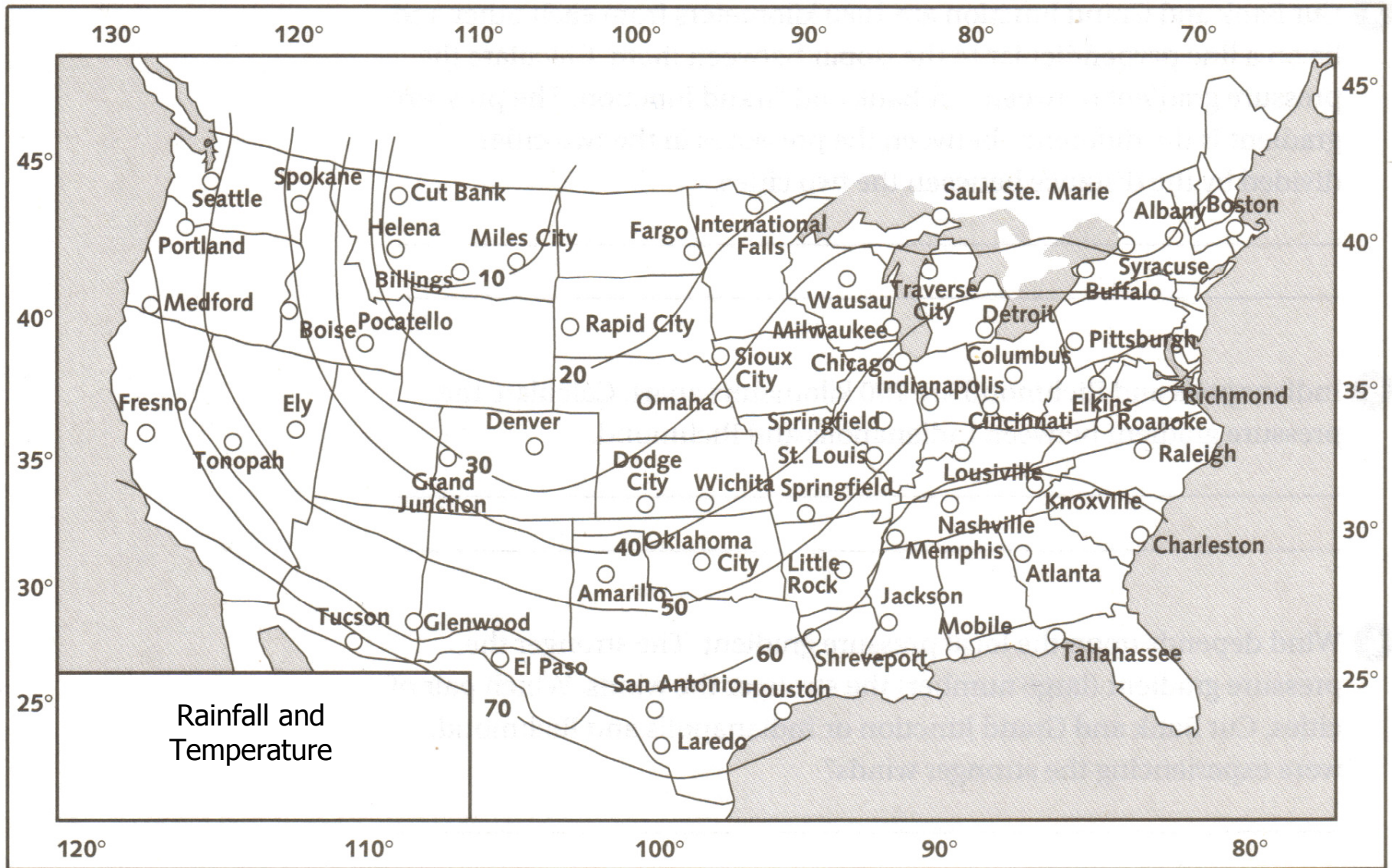
Materials: colored pencils

Procedure:

1. Look over the U.S. Cities Weather Data Table. The cities on the data table have been grouped according to a range of air pressures. On the weather map entitled *Air Pressure and Temperature*, use the assigned colors below to color in the circles for the all the cities in each group.

   - Range 1: 992.1-996.0 mb – orange
   - Range 2: 996.1-1000.0 mb – green
   - Range 3: 1000.1-1004.0 mb – blue
   - Range 4: 1004.1-1008.0 mb – purple
   - Range 5: 1008.1-1012.0 mb – red
   - Range 6: 1012.1-1016.0 mb – brown
   - Range 7: 1016.1-1020.0 mb – yellow

2. Once you have colored in all the circles on the map, use the different colors to help you identify where to draw isobars for 996, 1000, 1004, 1008, 1012, 1016 millibars. Use a pencil to draw and label each isobar.

3. Using the same color as the city circles, lightly shade in each belt between the isobars.

4. Find the low pressure center and label it with a "L." Find the high pressure center and label it with an "H."

5. On the weather map entitled *Rainfall and Temperature,* use a red colored pencil to fill in the circles on the map for each city with an "R" (for rain) in the last column of the data table.

6. Use a pencil to carefully draw a circle that encloses all of the cities experiencing rain.

7. Draw the two fronts that are located within this circle. (**HINT: fronts extend outward from a low pressure center; use the temperatures of the cities**).

U.S. Cities Weather Data Table

City	Air Temp. (°F)	Air Pressure (mb)	Rain	City	Air Temp. (°F)	Air Pressure (mb)	Rain
Range 1- orange				**Range 4- purple**			
Indianapolis, IN	48	995.1	R	Amarillo, TX	41	1007.8	
Louisville, KY	58	995.5	R	Buffalo, NY	35	1004.5	
Springfield, IL	45	994.9	R	Charleston, SC	65	1006.2	
St. Louis, MO	46	995.0	R	Dodge City, KS	33	1006.5	
Range 2- green				El Paso, TX	62	1007.9	
Chicago, IL	43	997.1		Fresno, CA	65	1007.3	
Cincinnati, OH	49	997.3	R	International Falls, MN	16	1007.2	
Columbus, OH	45	998.3	R	Laredo, TX	64	1005.2	R
Little Rock, AR	51	999.9	R	Medford, OR	61	1007.9	
Memphis, TN	61	998.5	R	Raleigh, NC	55	1005.1	R
Milwaukee, WI	39	998.5		Richmond, VA	53	1006.1	R
Nashville, TN	62	997.4		San Antonio, TX	61	1004.8	R
Springfield, MO	44	999.5		Sault Ste. Marie, MI	28	1004.1	
Range 3- blue				Sioux City, IA	23	1004.2	
Atlantic, GA	63	1002.6		Syracuse, NY	28	1006.8	
Detroit, MI	43	1000.1		Tallahassee, FL	65	1006.1	
Elkins, WV	48	1003.1	R	Tonopah, NV	54	1007.8	
Houston, TX	68	1003.9		Tucson, AZ	71	1007.5	
Jackson, MS	67	1001.5		**Range 5- red**			
Knoxville, TN	61	1000.5		Albany, NY	31	1008.5	
Mobile, AL	68	1003.9		Boise, ID	42	1011.1	
Oklahoma City, OK	43	1003.1		Boston, MA	35	1008.8	
Omaha, NE	31	1003.5		Ely, NV	46	1009.5	
Pittsburgh, PA	44	1002.0	R	Fargo, ND	17	1008.2	
Roanoke, VA	52	1003.5	R	Glenwood, KS	57	1008.8	
Shreveport, LA	66	1001.8	R	Portland, OR	58	1008.1	
Traverse City, MI	37	1001.5		Rapid City, SD	17	1011.7	
Wausau, WI	32	1001.5		Seattle, WA	53	1009.1	
Wichita, KS	35	1003.7		**Range 6- brown**			
				Denver, CO	25	1012.2	
				Grand Junction, CO	31	1013.2	
				Miles City, MT	9	1013.9	
				Pocatello, ID	29	1013.5	
				Spokane, WA	37	1012.8	
				Range 7- yellow			
				Billings, MT	8	1016.5	
				Cut Bank, MT	8	1016.3	
				Helena, MT	9	1016.8	

Air Pressure and Temperature

Rainfall and Temperature

Map labels (longitude, top): 130° 120° 110° 100° 90° 80° 70°

Map labels (latitude, right): 45° 40° 35° 30° 25°

Map labels (latitude, left): 45° 40° 35° 30° 25°

Map labels (longitude, bottom): 120° 110° 100° 90° 80°

City labels:
Seattle, Spokane, Cut Bank, Portland, Helena, Miles City, Fargo, International Falls, Sault Ste. Marie, Albany, Boston, Medford, Billings, 10, Wausau, Traverse City, Detroit, Syracuse, Buffalo, Boise, Pocatello, Rapid City, Milwaukee, Pittsburgh, Fresno, Ely, 20, Sioux City, Chicago, Columbus, Indianapolis, Richmond, Omaha, Springfield, Cincinnati, Elkins, Roanoke, Tonopah, Denver, 30, Dodge City, St. Louis, Louisville, Raleigh, Grand Junction, Wichita, Springfield, Knoxville, 40, Oklahoma City, Little Rock, Nashville, Charleston, Amarillo, 50, Memphis, Atlanta, Tucson, Glenwood, Jackson, Mobile, El Paso, 60, Shreveport, Tallahassee, San Antonio, Houston, 70, Laredo

Analysis and Conclusion Questions:

1. Identify the locations of the air masses that cover the United States and using the correct abbreviation, label them on the *Air Pressure and Temperature* map.

2. Cut Bank, MT and Grand Junction, CO are 1080 kilometers from each other. Calculate the pressure gradient between Cut Bank and Grand Junction. (INCLUDE FORMULA AND SHOW WORK).

3. Indianapolis and Richmond are 790 kilometers apart. Calculate the pressure gradient between Indianapolis and Richmond. (INCLUDE FORMULA AND SHOW WORK).

4. Wind depends upon the local pressure gradient. The larger the pressure gradient the stronger the winds. Which pair of cities, Cut Bank and Grand Junction, or Indianapolis and Richmond, are experiencing the stronger winds? _____

5. When a **cold front** passes over a city, where does precipitation occur (before the front passes the city, after the front passes the city, or both before and after)? _____
   _____

6. When a **warm front** passes over a city, where does precipitation occur (before the front passes the city, after the front passes the city, or both before and after)? _____
   _____

7. What are the two characteristics that are used to describe air masses? _____
   _____

8. Compare the characteristics of an air mass to its source region (the area where it came from). _____
   _____

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

a. Temperature- _____

b. Wind Patterns- _____

c. Cloud Cover- _____

d. Precipitation- _____

10. Describe the general weather conditions associated with a **low pressure** area in terms of:

a. Temperature- _____

b. Wind Patterns- _____

c. Cloud Cover- _____

d. Precipitation- _____

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

_____

_____

_____

Base your answers to questions 13 through 15 on the weather map below, which shows a low-pressure system over the central United States. Isobars are labeled in millibars. Points *A*, *B*, *C*, and *D* represent locations on Earth's surface.
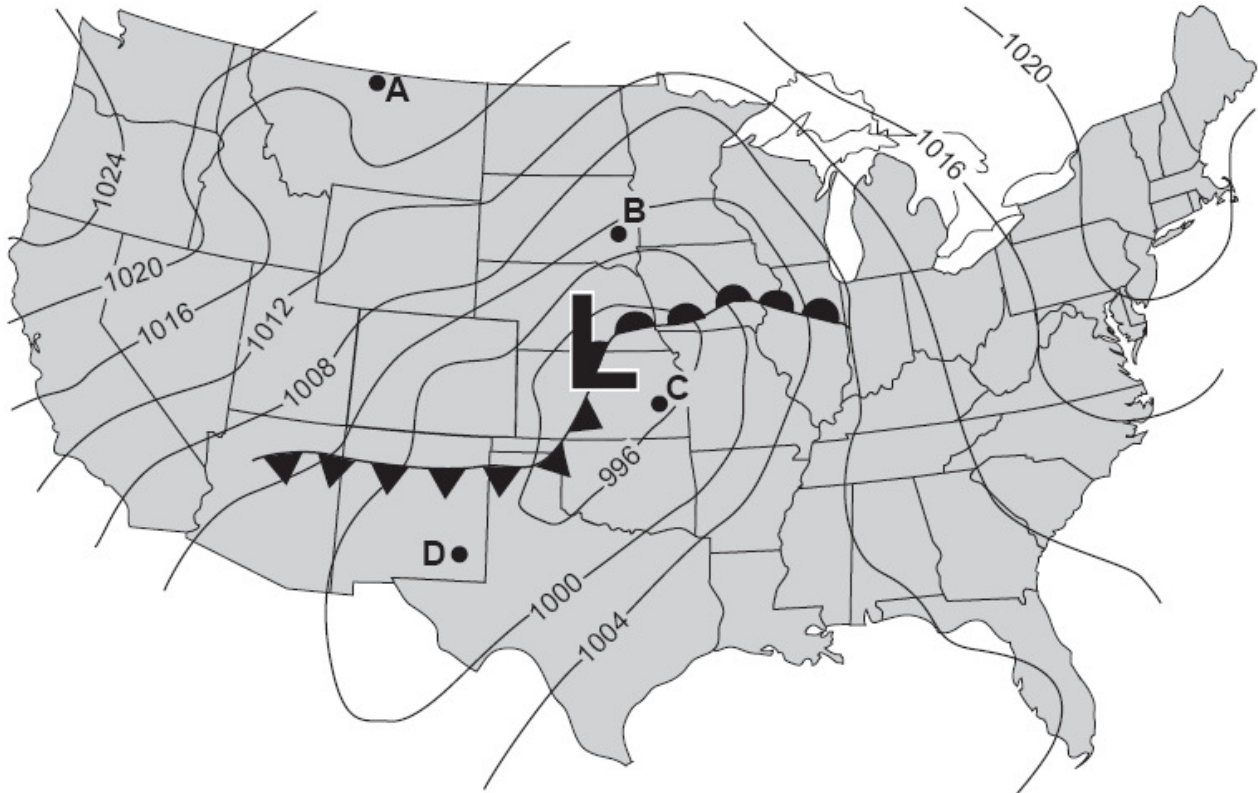
13. The circulation of surface winds associated with this low-pressure system is

       (1) clockwise and toward the center of the low
       (2) clockwise and away from the center of the low
       (3) counterclockwise and toward the center of the low
   (4) counterclockwise and away from the center of the low

14. The air pressure at the center of this low is

       (1) 991 mb   (2) 994 mb   (3) 997 mb   (4) 1001 mb

15. Which location is most likely experiencing the fastest wind speed?

       (1) *A*   (2) *B*   (3) *C*   (4) *D*

Base your answers to questions 16 through 19 on the weather map in your answer booklet, which shows a low-pressure system located over central United States. Points *A*, *B*, and *C* represent locations on Earth's surface. The isobars on the map show air pressures in millibars.
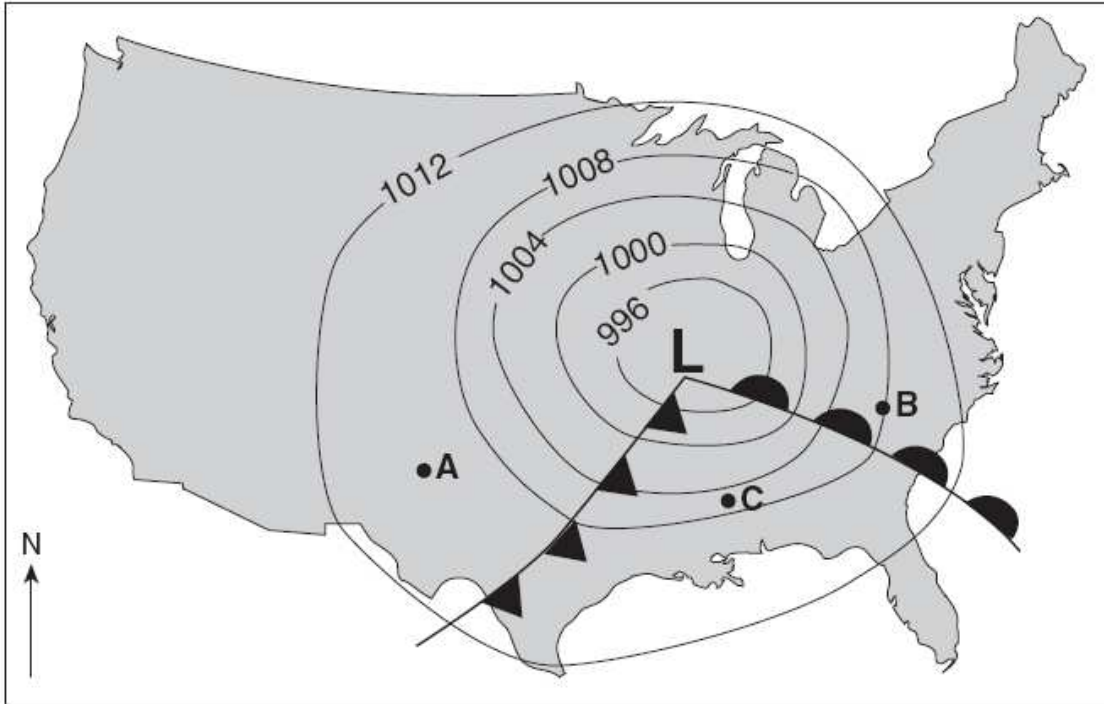
16. On the map *above*, draw an arrow, beginning at the **L**, to show the direction the low-pressure center will most likely move in the next two days. [1]

17. What evidence shown on the map indicates that point *B* is most likely experiencing precipitation? [1]

18. What is the two-letter symbol used on a weather map to indicate the warm, moist air mass that is over point *C*? [1]

_____

19. What evidence shown on the weather map indicates that point *C* is experiencing greater wind speeds than point *A*? [1]