METEOROLOGY

Unit 4:

Basics, Air Pressure, Humidity, Clouds, Precipitation, Temperature, Air Masses & Fronts, Severe Weather

Earth & Space

Name: _____

Period: _____

Room 606

Meteorology

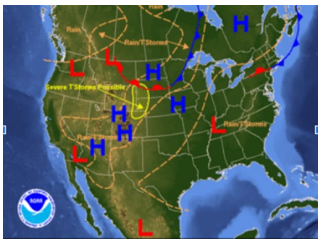
Key Learning:

Meteorology is the study of the atmosphere, atmospheric phenomena, and atmospheric effects on our weather. Meteorology is a subdiscipline of the atmospheric sciences, a term that covers all studies of the atmosphere. A subdiscipline is a specialized field of study within a broader subject or discipline. Climatology and aeronomy are also subdisciplines of the atmospheric sciences. Climatology focuses on how atmospheric changes define and alter the world's climates. Aeronomy is the study of the upper parts of the atmosphere, where unique chemical and physical processes occur. Meteorology focuses on the lower parts of the atmosphere, primarily the troposphere, where most weather takes place.

Meteorologists use scientific principles to observe, explain, and forecast our weather. They often focus on atmospheric research or operational weather forecasting. Research meteorologists cover several subdisciplines of meteorology to include: climate modeling, remote sensing, air quality, atmospheric physics, and climate change. They also research the relationship between the atmosphere and Earth's climates, oceans, and biological life.

Essential Questions

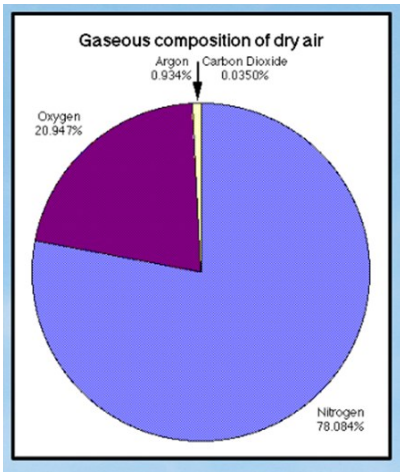
1. Why is meteorological problem solving different from other sciences?
2. How can air pressure alone give you a fairly accurate weather forecast?
3. How are air pressure and humidity related?
4. How can the cloud types help you to determine precipitation types and amounts?
5. How are temperature, air pressure and humidity related?
6. How does knowing the location of fronts help to improve forecasts?
7. How does severe weather forecasting relate to daily weather forecasts?



Meteorology Definition: The study of the _____ including _____ and _____.

Composition of the Atmosphere

- _____ (N_2) – 78%
- _____ (O_2) – 21%
- _____ (CO_2) - .03%
- Argon (Ar) – 1%
- All other gases - .1%



Three Basic Weather Characteristics

1.) _____: the amount of _____ (water vapor) in the atmosphere

2.) _____: the amount of _____ in the atmosphere

3.) _____: the _____ of the atmosphere at a particular place at a particular time

Using your laptop, fill in the following table using weather forecasts for Hanover, PA (17331) from 5 different agencies. These agencies can include government groups (NOAA, National Weather Service, etc.), news stations, etc. Make sure you are listing the actual forecasting group in the table. For example, Yahoo and Google may give you the weather forecast, but they get their forecasts from other groups. Make sure you are supplying the actual agency who forecasts the weather. Make sure you are filling in as much detail as each site allows when doing your forecast. Please include things like temperature, rainfall, wind conditions, humidity, etc.

Agency Name	**Forecast Day 1** **Date:**	**Forecast Day 2** **Date:**	**Forecast Day 3** **Date:**	**Forecast Day 4** **Date:**	**Forecast Day 5:** **Date:**

Air Pressure

Definition: the weight of a

_____

that extends from the

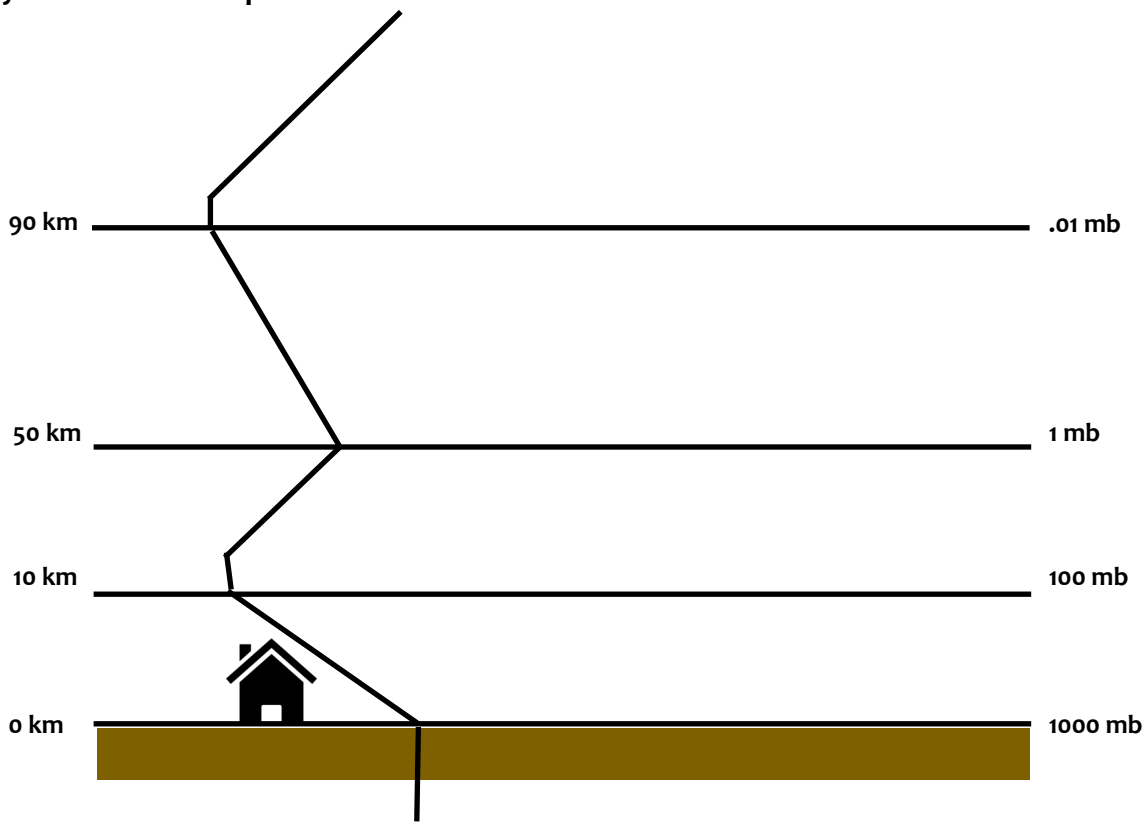
_____to the

_____.

Average Air Pressure = _____ psi - OR-

- *760 mm Hg - OR -*
- *1013.25 mb - OR-*
- *1 atm*

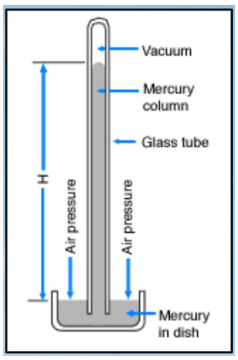
Layers of the Atmosphere



Measuring Air Pressure

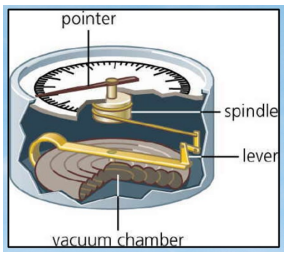
_____: instrument used to measure air pressure

Two Types:



1. _____ **Barometer**

   • uses the element _____ to measure air pressure



2. _____ **Barometer**

   • uses a _____ to determine air pressure

Air Movement

- Called _____
- Air moves from areas of _____ pressure ***to*** areas of _____ pressure

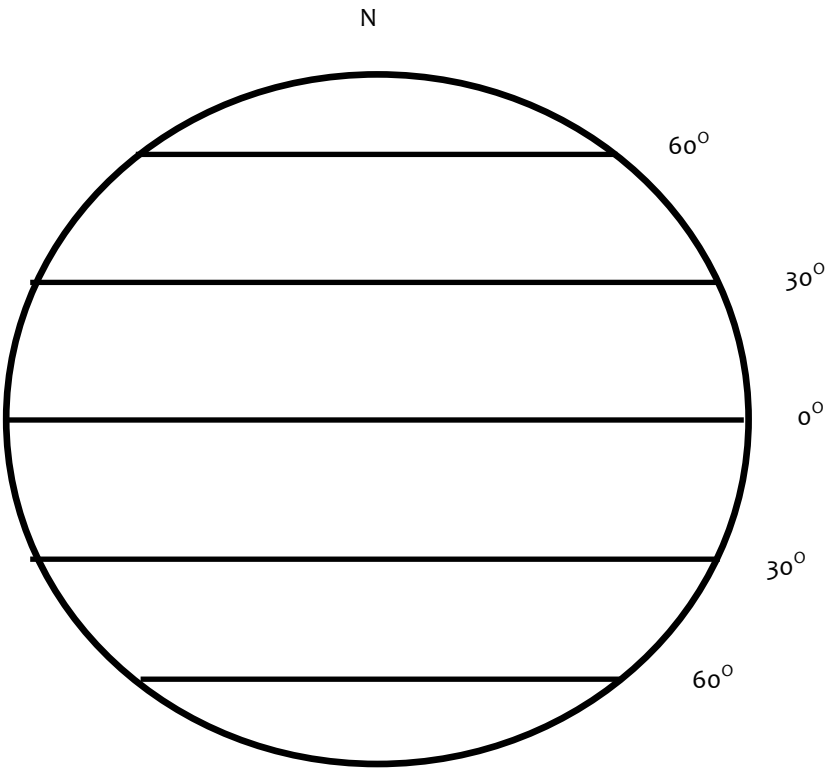
***** water follows the same rules as air!

Generally:

- High Pressure = _____ Weather = _____ rotation (anti-cyclone)*****
- Low Pressure = _____ Weather = _____ rotation (cyclone)*****

*****In the Northern Hemisphere

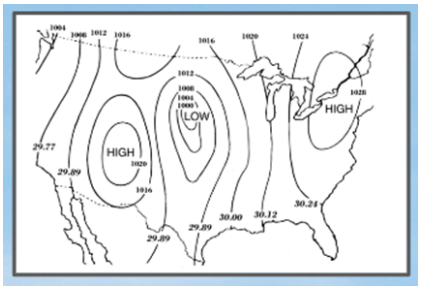
Global Wind Patterns



- _____: fast moving "_____" of air moving through the upper atmosphere

    * created at boundaries _____

Measuring Air Pressure on a Weather Map



- _____

  - lines that _____

    _____

  - _____ spaced isobars indicate a _____ change in pressure and _____ wind speeds

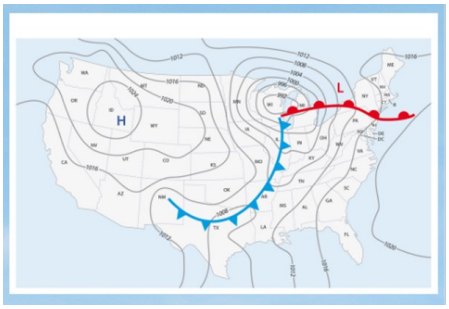
  - _____ spaced isobars indicate a _____ change in pressure and _____ wind speeds

Rules for Placing Isobars

1. _____
   - indicates an area with two different air pressures at the same time
2. _____
   - indicates areas with no air pressure which doesn't happen

NOTE: When drawing isobars, start with either the highest number or the lowest number. Do NOT start in the middle!

Identifying Pressure on a Map



1. Only mark _____ *and* _____
2. The **lowest pressure** on the map is the center of **Low Pressure**
3. The **highest pressure** on the map is the center of **High Pressure**

Drawing Isobars & Labeling Pressure Systems #1

Drawing Isobars & Labeling Pressure Systems #2

Isobaric Map Forecasting

Directions:

A. On page 12, create your isobaric map.

B. Once you have created your isobaric map, use it to answer the following questions:

Questions:

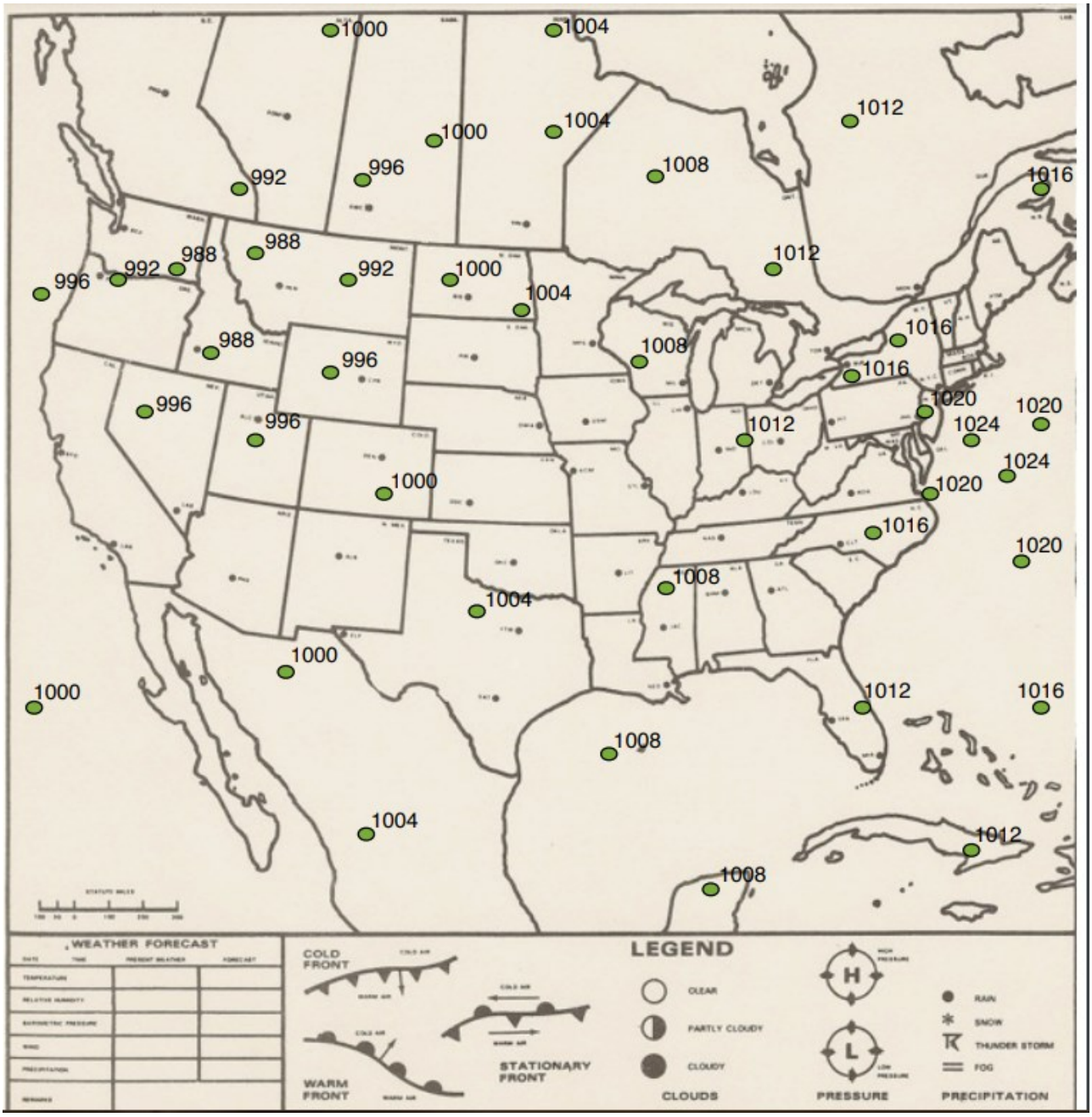
1. What is the weather like in Utah?

2. Is it rainy or sunny in California? How do you know?

3. Are the wind speeds higher in Washington or Texas? How do you know?

4. What is the weather like in Pennsylvania? How can you tell?

5. Label the low pressure center and high pressure center on the map.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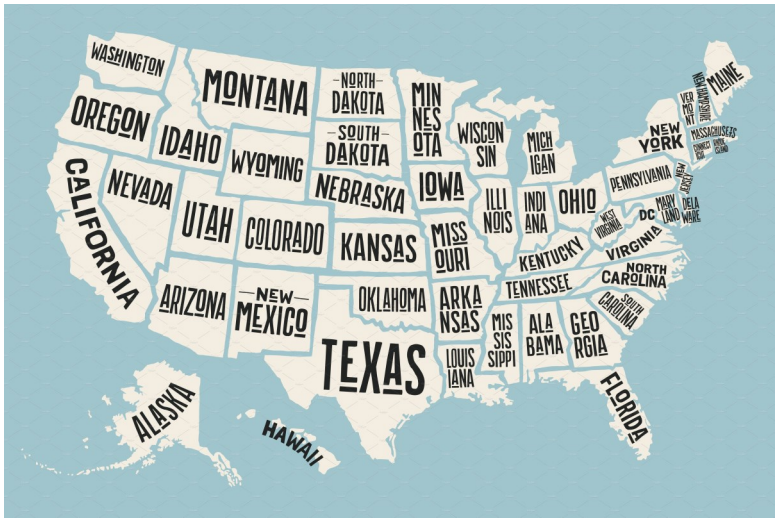
WEATHER FORECAST
COLD FRONT
WARM FRONT
STATIONARY FRONT
LEGEND
CLEAR
PARTLY CLOUDY
CLOUDY
CLOUDS
H
L
PRESSURE
RAIN
SNOW
THUNDER STORM
FOG
PRECIPITATION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NORTH DAKOTA
MINNESOTA
WISCONSIN
MICHIGAN
NEW YORK
MAINE
OREGON
IDAHO
WYOMING
SOUTH DAKOTA
PENNSYLVANIA
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
INDIANA
OHIO
KANSAS
MISSOURI
KENTUCKY
VIRGINIA
TENNESSEE
NORTH CAROLINA
ARIZONA
NEW MEXICO
OKLAHOMA
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
SOUTH CAROLINA
TEXAS
LOUISIANA
FLORIDA
ALASKA
HAWAII

Humidity

Definition: measure of the _____ in the air.

- **Absolute Humidity:** the _____ of water found in the air

  - Warm air is _____ dense

    * more space between the molecules so it has more area to hold water vapor

    * therefore _____has the ability to hold more moisture than cold air

- **Saturation Value:** The _____ amount of water air can hold at a given temperature.

- **Relative Humidity:** The amount of ***water*** in the air _____ to the ***maximum amount*** of water the air can hold

  Relative Humidity = Absolute Humidity / Saturation Value (Formula: RH = AH / SV)

  Relative Humidity is recorded as a percentage

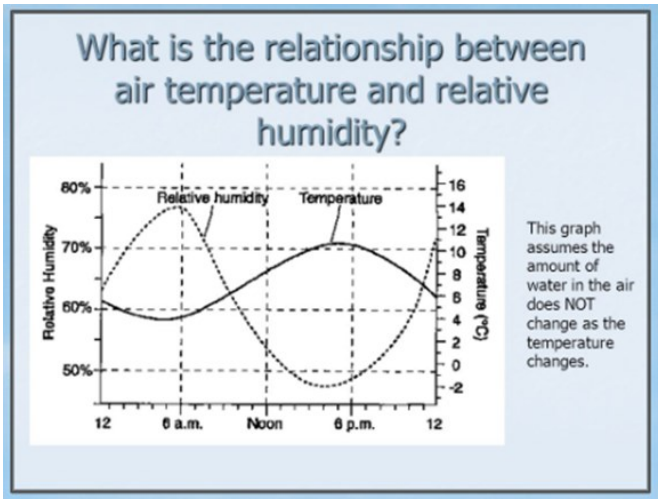
Relative Humidity & Temperature

- As temperature _____,

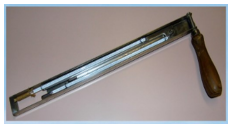
relative humidity _____.

- As temperature _____,

relative humidity _____.



Measuring Humidity



1. _____: Instrument that measures the humidity using evaporation of water and the air temperature

2. _____**:** Instrument that measures relative humidity using the "_____" of hair

Sling Psychrometer Lab

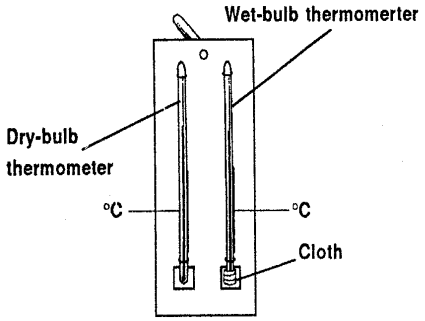
Measuring Relative Humidity Using A Sling Pyschrometer

Background: The amount of water vapor in air compared with the maximum amount of water vapor that the air can hold at a given temperature is called *relative humidity*. Relative humidity can be measured with a sling psychrometer. A psychrometer makes use of the cooling effect of evaporation. As water evaporates from a surface, it cools the surface. Water will evaporate more quickly into dry air than into humid, moist air. The more a wet surface is cooled by evaporation, the more quickly evaporation is taking place – the drier the air.

Objective: In this activity you will use a sling psychrometer to determine the relative humidity of the air

Skills: measuring, interpreting a chart, comparing

Materials: sling psychrometer, water, timing device



Precautions:

1. Always take your reading over vegetation. (Do not measure over concrete or blacktop)
2. Take your readings out of direct wind (Too much drying of the wet bulb)
3. Re-wet the wet bulb after each reading

Procedure:

1. The thermometer with the cloth is called a wet-bulb thermometer. Wet the cloth with room temperature water.

2. Spin the psychrometer for 20 seconds. Read both thermometers **(Use Celsius reading).** Record the temperatures in the Table 1. Subtract the wet-bulb temperature from the dry bulb temperature and record the difference in the Table 1.

3. Continue spinning the psychrometer and checking the temperature in 20 second increments ***until there is no further change or until two minutes have past.*** Record those temperatures as final temperatures in Table 1.

4. Subtract the wet-bulb temperature from the dry-bulb temperature. Record the difference in Table 1.

5. You will now move to a new location and repeat the steps. Record your data in Table 2.

6. Move 3 more times and complete the same steps each time. Use Table 3 at location 3, Table 4 at location 4 and Table 5 at location 5.

7. In each table, circle the two numbers that represents the final dry-bulb temperature the final temperature difference.

8. Average the final dry bulb-temperature and record it in Table 6 (Average Readings). Find the average for the final temperature difference and record it in Table 6 (Average Readings).

9. On the humidity chart provided, locate the two circled values from table 6 (Average Readings)

Note: Dry-bulb temperature is on the left hand side and the temperature difference is along the top.

Follow the temperature difference down and the dry-bulb temperature to the right until the two lines meet. Circle this value. This value represents the relative humidity of the air.

11. Answer the questions on page 16.

Table 1 - Measuring Relative Humidity (Location 1)

	Dry-Bulb Temperature (°C)	Wet-Bulb Temperature (°C)	Temperature Difference (°C)
After 20 Seconds			
After 40 Seconds			
After 1 minute			
After 1 minute 20 seconds			
After 1 minute 40 seconds			
2 minutes			

Table 2 - Measuring Relative Humidity (Location 2)

	Dry-Bulb Temperature (°C)	Wet-Bulb Temperature (°C)	Temperature Difference (°C)
After 20 Seconds			
After 40 Seconds			
After 1 minute			
After 1 minute 20 seconds			
After 1 minute 40 seconds			
2 minutes			

Table 3 - Measuring Relative Humidity (Location 3)

	Dry-Bulb Temperature (°C)	Wet-Bulb Temperature (°C)	Temperature Difference (°C)
After 20 Seconds			
After 40 Seconds			
After 1 minute			
After 1 minute 20 seconds			
After 1 minute 40 seconds			
2 minutes			

Table 4 - Measuring Relative Humidity (Location 4)			
	Dry-Bulb Temperature (°C)	Wet-Bulb Temperature (°C)	Temperature Difference (°C)
After 20 Seconds			
After 40 Seconds			
After 1 minute			
After 1 minute 20 seconds			
After 1 minute 40 seconds			
2 minutes			
Table 5 - Measuring Relative Humidity (Location 5)			
After 20 Seconds			
After 40 Seconds			
After 1 minute			
After 1 minute 20 seconds			
After 1 minute 40 seconds			
2 minutes			
Table 6 - Average Readings			
Avg. Dry Bulb Temperature		**Avg. Final Temp. Difference**	

DRY-BULB TEMPERATURE (°C)	DIFFERENCE BETWEEN DRY-BULB AND WET-BULB TEMPERATURES (°C)									
	1	2	3	4	5	6	7	8	9	10
– 4°	77	55	33	12						
– 2°	79	60	40	22						
0°	81	64	46	29	13					
2°	84	68	52	37	22	7				
4°	85	71	57	43	29	16				
6°	86	73	60	48	35	24	11			
8°	87	75	63	51	40	29	19	8		
10°	88	77	66	55	44	34	24	15	6	
12°	89	78	68	58	48	39	29	21	12	
14°	90	79	70	60	51	42	34	26	18	10
16°	90	81	71	63	54	46	38	30	23	15
18°	91	82	73	65	57	49	41	34	27	20
20°	91	83	74	66	59	51	44	37	31	24
22°	92	83	76	68	61	54	47	40	34	28
24°	92	84	77	69	62	56	49	43	37	31
26°	92	85	78	71	64	58	51	46	40	34
28°	93	85	78	72	65	59	53	48	42	37
30°	93	86	79	73	67	61	55	50	44	39
32°	93	86	80	74	68	62	57	51	46	41
34°	93	87	81	75	69	63	58	53	48	43
36°	94	87	81	75	70	64	59	54	50	45

RELATIVE HUMIDITY (%)

Analysis: Based on your data complete the blanks with the words higher or lower!

The _____ the humidity, the _____ the rate of evaporation and so the _____ the temperature recorded.

Clouds

- **Need:**

1. _____

2. _____**:** particle for water to condense onto

Cloud (and Fog) Formation

1. _____: when a warmer body of air mixes with a cooler body of air causing it to drop below the ***Dew Point Temperature***

- _____: is the temperature at which air is at **100%** _____

2. _____ **Cooling:**

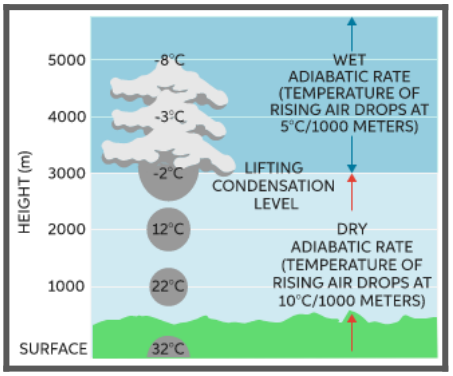
- When a warm body of air moves across a cooler surface causing it to cool to the Dew Point Temperature.

3. _____ **Cooling:**

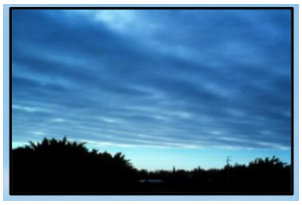
- As air rises it expands and cools and eventually reaches the Dew Point Temperature

- no energy is added or removed from the system

- Only clouds



Cloud Types



1. _____
   - _____ altitude
   - Means "Sheet-like" or " _____"
   - Usually _____ from these clouds

2. _____
   - _____ altitude
   - Means "_____" or "heaped"
   - "_____ Clouds"
   - May form into _____Clouds (thunderstorm clouds)

3. _____
   - _____Altitude
   - Means "_____" or "feathery"
   - Made from _____

Precipitation

Definition: anything that is _____ and

_____ the base of a cloud

Types:

1. _____: _____ when it leaves the cloud and a _____ when it hits the ground

2. _____: _____ when it leaves the cloud and a _____ when it hits the ground

3. _____: _____ when it leaves the cloud and a _____ when it hits the ground (frozen raindrops)

4. _____: made only during thunderstorm (cumulonimbus clouds)

5. _____: _____ when it leaves the cloud and becomes a _____ **immediately** upon touching the ground (super-cooled water)

Precipitable Water Lab

⇒ Additional Packet

Temperature

Definition: measure of the

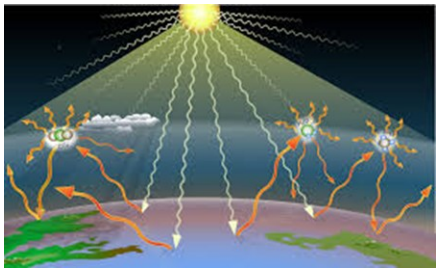
_____of a group of molecules

- measure of the amount of heat energy in an object

Temperature's effect on the Atmosphere

- _____ *or* _____ *air*
- _____ *(or sinks)*
- Rising or falling air allows for _____ *and* _____ *changes*

Greenhouse Effect

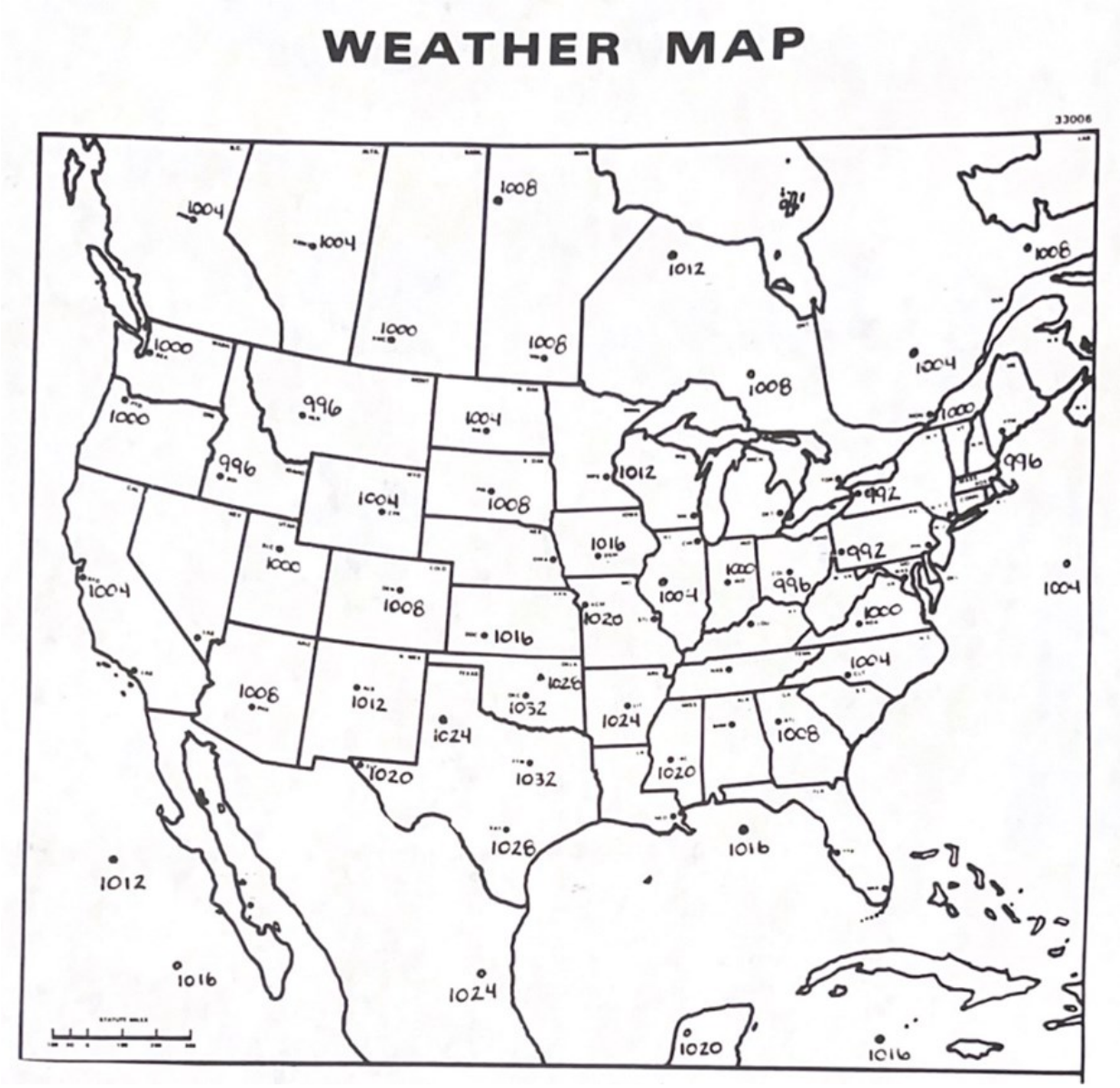


- _____ always a bad thing
- _____ energy enters the atmosphere and is converted to long wave energy
- _____ energy is then trapped at the Earth's surface

Cloud's effect on Atmosphere

- Cloudy nights are _____ due to clouds trapping heat at the surface
- Clear nights are _____ due to heat escaping (radiative cooling)

Forecasting with Air Pressure, Humidity & Temperature #1 Worksheet



1. Draw in the following isobars:

992 996 1000 1004 1008 1012 1016 1020 1024 1028 1032 millibars

Remember to use your rules for drawing isobars!

2. Once you have finished drawing in the isobars, answer the questions on page 22.

FORECASTING WITH AIR PRESSURE, HUMIDITY AND TEMPERATURE

1.) Is the weather rainy or sunny in Pennsylvania? How can you tell?

2.) Would the humidity in Texas be high or low? How can you tell?

3.) In which part of the country are there higher wind speeds?

4.) Would the temperature in Montana be higher or lower than the temperature in North Dakota? What information did you use to determine this?

5.) Since weather moves from the southwest to the northeast what will be happening to temperatures in New England over the next several days?

6.) Would the humidity be higher in New Mexico or in Ohio? How can you tell?

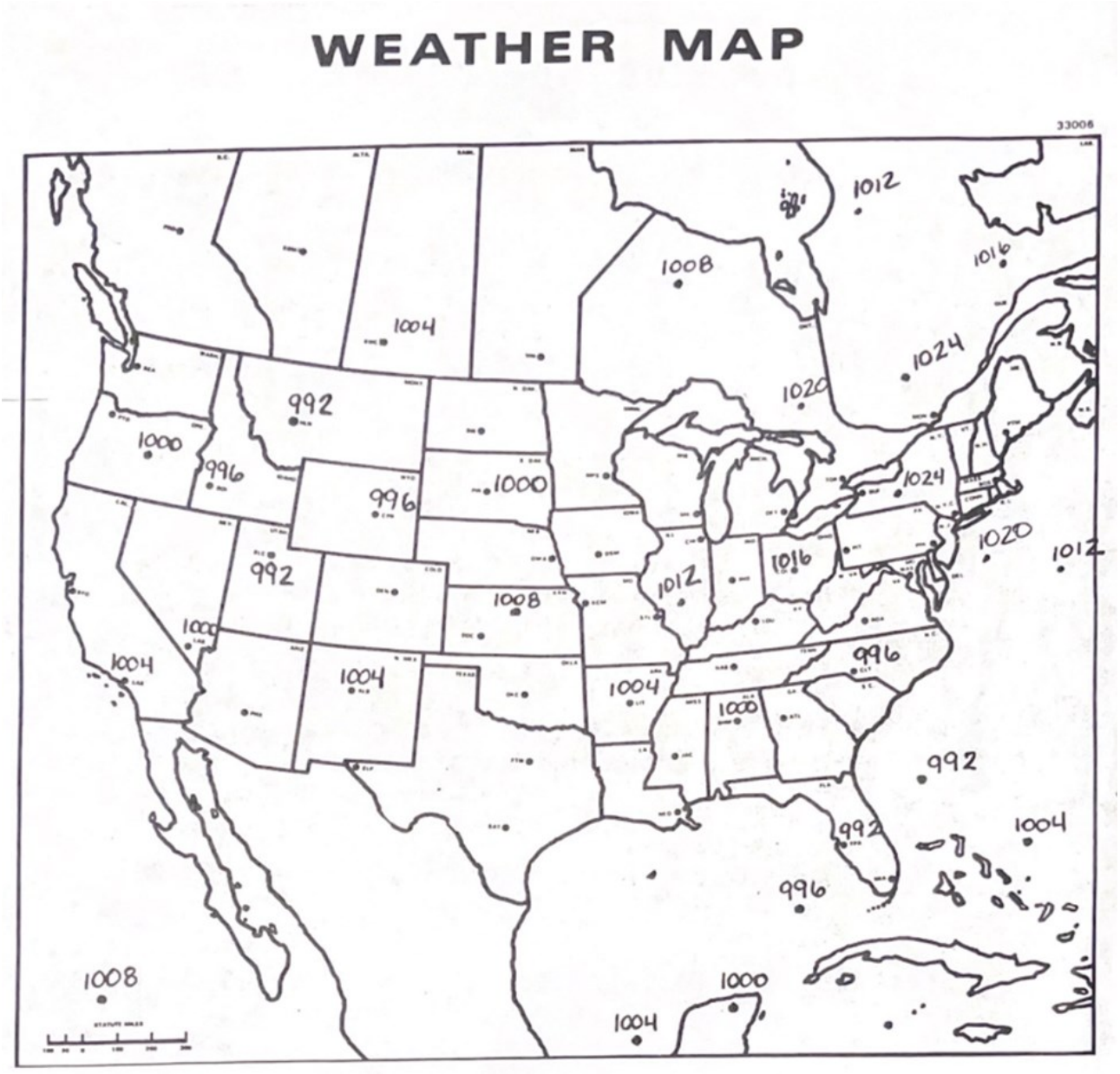
7.) Which state would have the "nicest" weather? the "worst" weather? What information did you use to determine this?

8.) Which direction is the wind generally blowing from on this map?

9.) In which state would you find the lowest humidity? How do you know this?

10.) Is the weather "nice" in California? How have you determined this?

Forecasting with Air Pressure, Humidity & Temperature #2 Worksheet



1. Draw in the following isobars:

992 996 1000 1004 1008 1012 1016 1020 1024 1028 1032 millibars

Remember to use your rules for drawing isobars!

2. Once you have finished drawing in the isobars, answer the questions on page 24.

FORECASTING WITH AIR PRESSURE, HUMIDITY AND TEMPERATURE II

1.) Is the weather rainy or sunny in Utah? How can you tell?

2.) Would the temperature in New York be high or low? How can you tell?

3.) In which part of the country are there higher wind speeds?

4.) Would the temperature in Montana be higher or lower than the temperature in Ohio? What information did you use to determine this?

5.) Since weather moves from the southwest to the northeast what will be happening to temperatures in New England over the next several days?

6.) Would the humidity be higher in New Mexico or in Ohio? How can you tell?

7.) Which state would have the "nicest" weather? the "worst" weather? What information did you use to determine this?

8.) Which direction is the wind generally blowing from on this map?

9.) In which state would you find the lowest humidity? How do you know this?

10.) Is the weather "nice" in Florida? How have you determined this?

Fronts and Air Masses

Air Mass: large body of air with the same _____ and _____ throughout.

Types:

1. _____ (mP) – cold, humid air mass
2. _____ (mT) – warm, humid air mass
3. _____ (cP) – cold, dry air mass
4. _____ (cT) – warm, dry air mass
5. _____ - above arctic circle, VERY COLD

Fronts: _____ of an air mass

*** Fronts are located around LOW PRESSURE systems ONLY! ***

- The low pressure system acts like a vacuum: As air rises, it pulls in masses (both cold and warm)
- Fronts will show where cold and warm air masses are located.

Types of Fronts:

1. Cold Fronts

- Produce _____ in the summer
- Produce _____ in the winter
- Move in and out _____

2. **Warm Fronts**

- Produce _____ in the summer
- Produce _____ in the winter
- Move in and out _____; may take a day or two to move through
- Bring in _____ clouds

3. **Stationary Fronts**

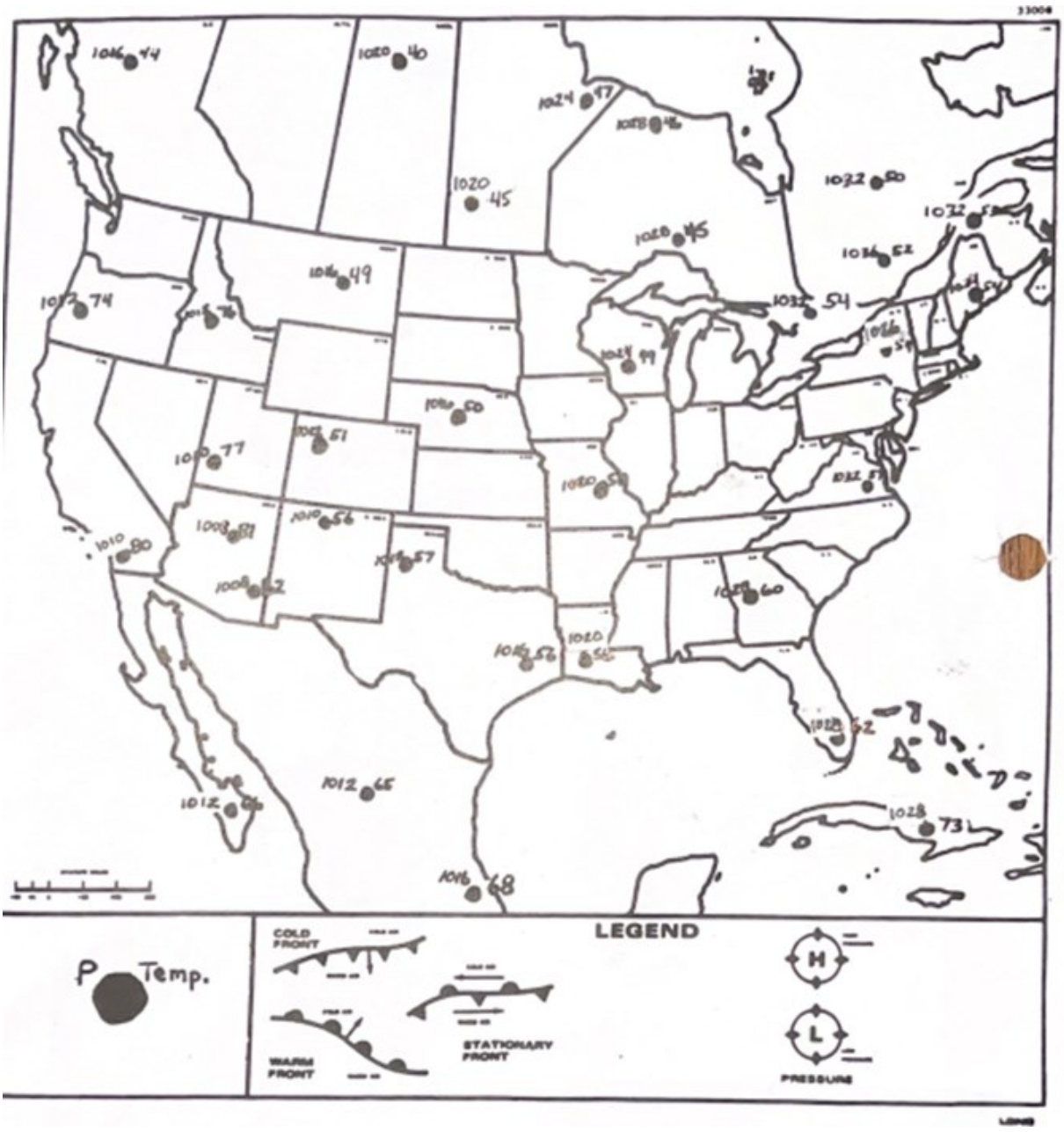
- _____ periods of

  _____ or _____
- Stationary = _____
- Only 1 to 2 degree difference in temperature; density is almost the same

4. **Occluded Fronts**

- Extended periods of rain or snow (not as long as stationary fronts)
- Very ugly in the winter; cause temperature inversions resulting in wintery mix

Air Mass and Fronts Forecasting Worksheet #1



1. Draw in the following isobars. ***Remember to use your rules for drawing isobars!***

1008 1012 1016 1020 1024 1028 1032 1036 millibars

2. Label the High and Low Pressure Centers

3. Place the warm and cold fronts in the correct place around the *low* pressure system.

4. Once you have finished tasks 1-3, answer the questions on page 28.

Forecasting:

1. **What would the weather be like the following areas?**
   - ***Include***:

     - Humidity (High or Low)

     - Cloud Cover

     - Temperature (Increasing or Decreasing)

     - Air Pressure (Increasing or Decreasing)

1.) Nevada

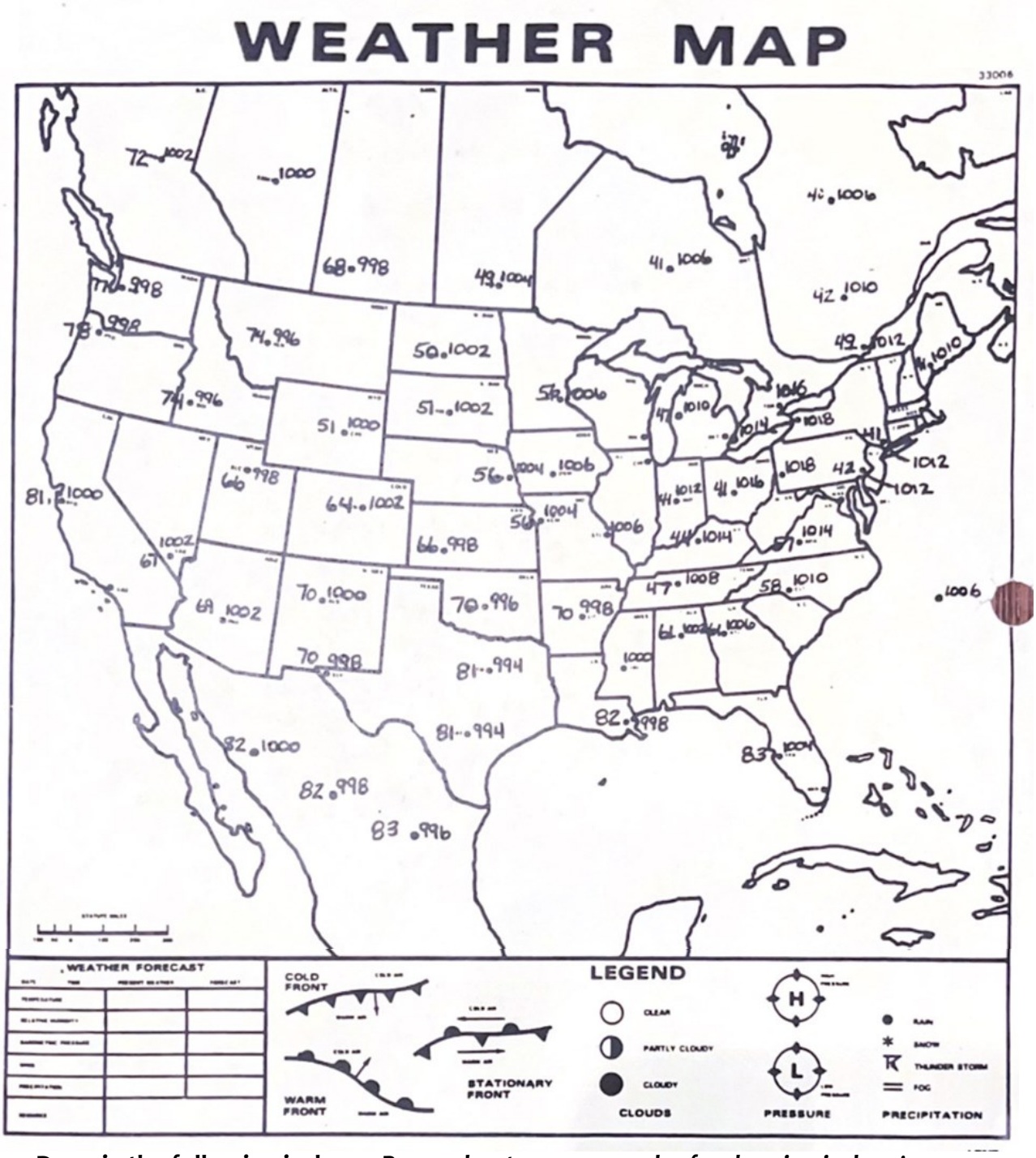
2.) New Mexico

3.) Idaho

4.) New York

5.) South Dakota

Air Mass and Fronts Forecasting Worksheet #2



1. Draw in the following isobars. ***Remember to use your rules for drawing isobars!***

996 998 1000 1002 1004 1006 1008 1010 1012 1014 1016 1018 millibars

2. Label the High and Low Pressure Centers

3. Place the warm front and cold front in the correct place around the *low* pressure system.

4. Once you have finished tasks 1-3, answer the questions on page 28.

Forecasting:

1. **What would the weather be like the following areas?**

   - ***Include***:

     - Humidity (High or Low)

     - Cloud Cover

     - Temperature (Increasing or Decreasing)

     - Air Pressure (Increasing or Decreasing)

1.) Montana

4.) Utah

2.) New Mexico

5.) West Virgina

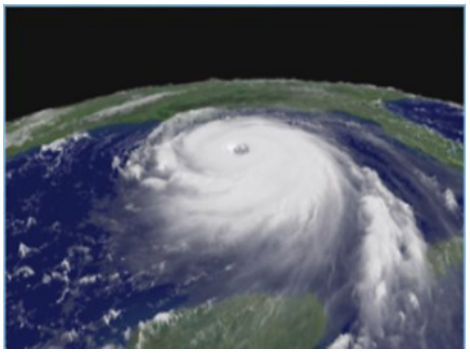
3.) Louisiana

6.) Florida

Severe Weather

Types:





_____ _____ _____

Thunderstorms

- Small, _____storm system caused by the _____, _____ air

Thunderstorm Ingredients

4 "ingredients" necessary:

1. _____
2. _____
3. Some form of _____
4. _____ (unstable atmosphere)

Mass vs. Front Thunderstorms

- **Air Mass Thunderstorm:**

  Hot & Humid —> Storm —> _____

- **Front Thunderstorm:**

  Hot & Humid —> Storm —> _____

Thunderstorm Hazards

1. _____ (1,000,000 volts)
   (Thunder is created by superheated air)
2. _____
3. _____
4. _____
5. _____

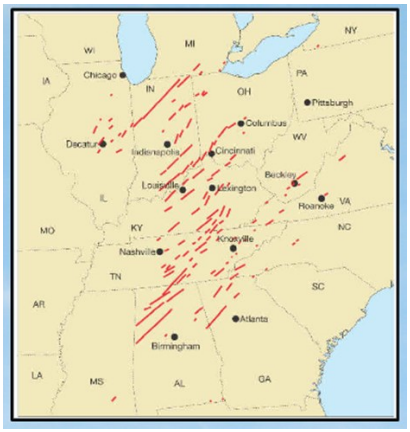
Tornadoes

Characteristics of Tornadoes

- _____ of all atmospheric disturbance
- Average _____ in diameter
- Up to a _____ pressure change from outside to the center of the tornado
- Wind speeds between _____ and _____ mph
- Move at _____ along the surface
- Last anywhere from _____ minutes to _____ hours

Super Outbreak

- 1974
- 148 tornadoes in 24 hours
- 315 people killed
- Over $600 million in damage



Watch vs. Warning

_____: Conditions are good for the _____ of severe weather

_____: severe weather _____ and could take place near you

Tornado Season

- _____ —> _____

Tornado Hazards

- Extremely high wind speeds
- Strong _____ (100 mph)
- Multiple _____ (most dangerous)
- Abrupt drop in _____

Enhanced Fujita Tornado Intensity Scale

- Known as the _____ *(use to be the F Scale)*
- Scale from _____
- EF0 are weak (79%), EF5 are strong (1%)

ORIGINAL F SCALE	EF SCALE
F0 40- 72 mph	EF0 65- 85 mph
F1 73-112	EF1 86-110
F2 113-157	EF2 111-135
F3 158-206	EF3 136-165
F4 207-260	EF4 166-200
F5 261-318	EF5 over 200 mph

Hurricanes

- Created between _____ and _____Latitude
- West of the International Dateline they are called _____
  (generally larger than Atlantic Hurricanes)

Hurricane Formation

1.) _____ (over 80°F)

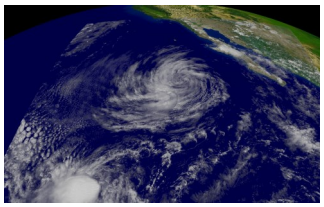
2.) Air Mass moving off the Sahara Desert

3.) _____

Hurricane Stages

1)_____

- _____
  speeds up to 38 mph
- _____ pressure system
- No name given; Uses a _____ system



2) _____

- Sustained wind speeds from 39-73 mph
- Use Female / Male Names

3) _____

- Sustained wind speeds of 74 mph and up
- Use Female / Males Names

Saffir-Simpson Hurricane Intensity Scale

Saffir-Simpson Scale

Category	Wind Speed (mph)
1	74-95
2	96-110
3	111-130
4	131-155
5	>155

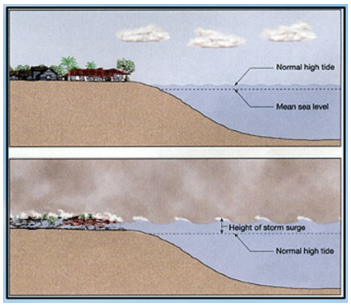
Hurricane Season

- _____ —> _____

Hurricane Hazards

- Strong _____
- Possible _____
- Heavy _____
- _____

  - large dome of seawater pushed onshore by the hurricane



Study Guide

Meteorology Unit Study Guide

1. **Define meteorology**

2. **The most abundant gas in the atmosphere by volume is _____. This gas comprises 78% of the Earth atmosphere by volume.**

   a. Oxygen b. Argon c. Carbon Dioxide d. Nitrogen

3. **In what part of the atmosphere does the vast majority of our weather take place?**

   a. Mesosphere b. stratosphere c. troposphere d. thermosphere

4. **Name the 3 big weather characteristics**
   A. _____
   B. _____
   C. _____

5. **In terms of pressure, how does air move?**

6. **In general, _____ pressure means we will have nice weather. _____ pressure means we will have bad weather.**

7. **When measuring pressure on a weather map, these are the lines that connect areas of equal air pressure.**
   A. Isotherms
   B. Isotachs
   C. Isobars

8. **High wind speeds mean isobars** (are closely spaced / are widely spaced).

9. **What are the two rules for isobars?**

   A. _____

   B. _____

10. **What instrument is used to measure air pressure?** _____

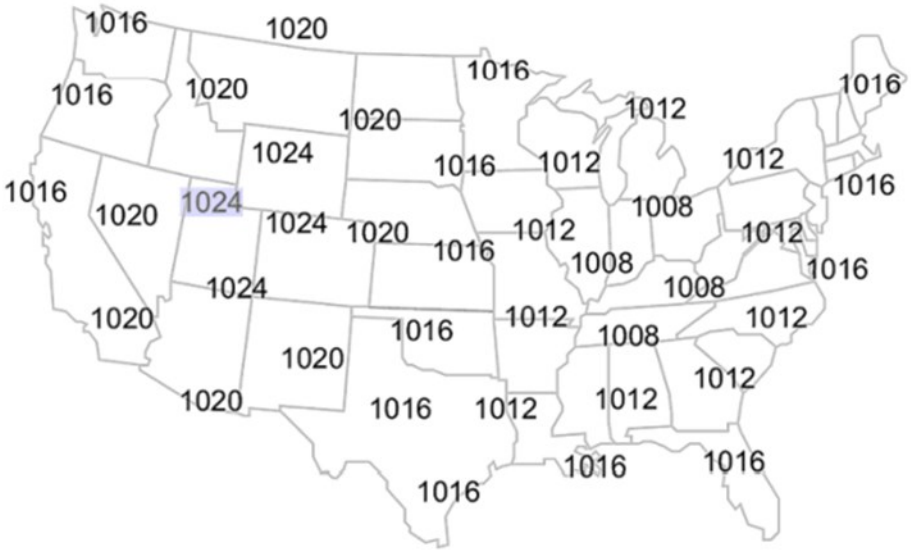
11. **In the northern hemisphere, which way does air move/flow near areas of high pressure?**

    a. Directly towards low pressure b. Counter-clockwise c. Clockwise d. North to south

12. Match the term with the correct definition

_____Temperature	A. Weight of the atmosphere in a particular place at a particular time
_____ Air Pressure	B. Amount of heat in the atmosphere
_____ Humidity	C. Amount of moisture (water vapor) in the atmosphere

13. Use the Air Pressure Map to complete the activities that follow:



13a. Draw in your isobars

13b. Label the center of the high pressure area with a large "H".

13c. Label the center of the low pressure area with a large "L".

13d. Shade, in green, the state(s) would you expect to see rain or snow.

13e. Shade, in yellow, the state(s) would you expect to see clear skies.

14. Explain the jet stream

15. **Look at the figure below; if the jet stream shifts north what affect will it have on the temperature in the north? The south?**

north: _____

south: _____

16. **What instrument is used to measure humidity?** _____

17. **If moisture stays the same but it gets warmer, does the relative humidity increase or decrease?**

18. **If the air temperature remains constant, evaporating water into the air, will ____ the dew point and ____the relative humidity.**

a. increase; increase
b. increase; decrease
c. decrease; increase
d. decrease; decrease

19. **Use the surface pressure change map to complete the activities that follow:**

19a. Draw in the edge of the cold front
19b. Draw in a black line where the cold and warm front meet
19c. Draw in the edge of the warm front (there are 2 areas!)

20. Bob watched the weather with his parents on Thursday night. He told his dad that he should take an umbrella with him because there is a warm front moving in that will bring warmer temperatures, but also rain to the area. He also told him that it's going to be pretty sticky since humidity would be also be increasing. Is Joe's explanation of the weather correct or incorrect? Explain why!

21. Joe Calhoun stated that as the low pressure system moves over Pennsylvania the weather will continue to improve bringing sunny skies and nice weather to the region. Is Joe's forecast accurate? Why or Why Not?

22. Sally was studying her notes for her meteorology test when she noticed she was missing information. She had written down that as temperatures decrease a cold front is approaching and thunderstorms will take place. But, she had nothing about air temperature and humidity. If you were her partner, what would you tell her happens to air pressure and humidity during a cold front? Why?

23. The figure below shows a low pressure system over the central plains. In the figure, **the fronts are denoted by I and II**, the areas with clouds are encircled by the dash-dot line, and the dotted line is the 0°C line.

23a. Identify what types of front is located at "I"

23b. Identify what type of front is located at "II "

24. You, who are at point A, are talking with your good friends that live at point B and C about the weather. **Choose the description that best fits what you or your friends would be experiencing by placing A, B, or C in front of the description.**

_____ **24a**. "Well, over here it's been snowing quite a bit, very slushy. The winds seem to be coming from the East. The TV weather person says that we can expect more snow."

_____**24b**. "Over here it was sunny and warm, really nice this morning, but now there are severe weather alerts everywhere!"

_____**24c**. "Nothing much out here, it's been cold and windy. I think the winds are coming from the northwest.

25. An air mass is a body of air with

a. equal density throughout
b. similar values of temperature and moisture in the horizontal
c. very high pressure everywhere
d. at least two frontal zones
e. very low humidity in its lower layers

26. Define "front"

27. Where are fronts located (i.e. where do you draw them)?

28. Identify the type of front

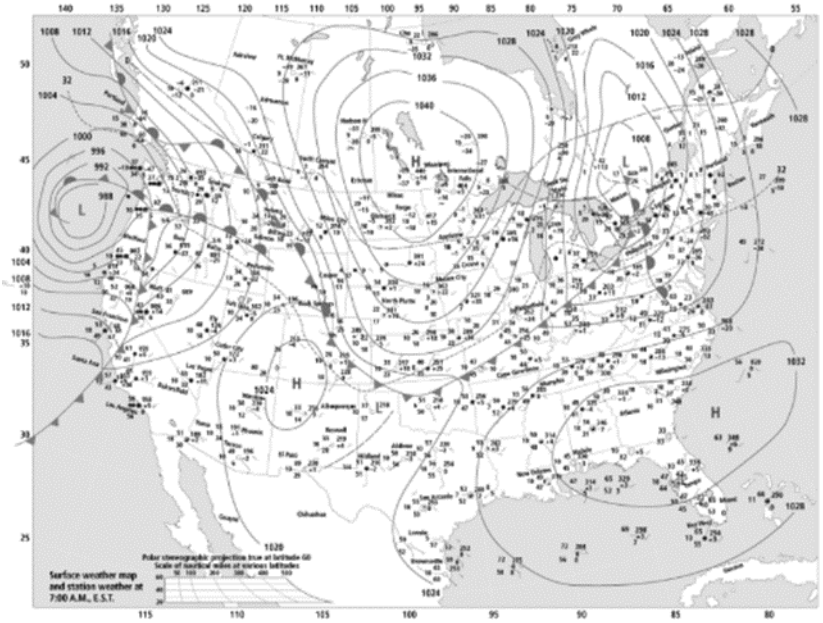
Movement of air masses	Type of front
An advancing warm air mass displaces a cold air mass and glides over the top of it.	a.
Two air masses with similar temperatures and pressures meet, and neither advances into the other's territory.	b.
A cold, dense air mass displaces a warm air mass and forces the warm air to rise steeply.	c.
A warm air mass is squeezed upward between two cold air masses.	d.

29. Complete the chart on Fronts

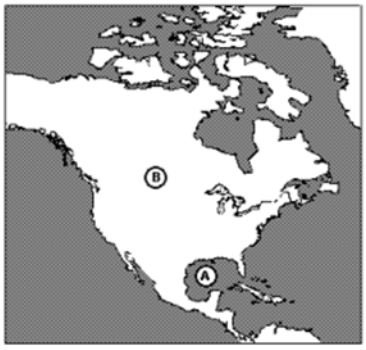
Name of Front	How it moves (quickly, slowly, etc)	Summer Weather	Winter Weather	Symbol on a map
Occluded				
	May take a day or more to move through			
				
			Extended periods of snow	

30. In the figure, what type of front is coming through Canada and into Colorado?

a. Warm b. cold c. stationary d. occluded

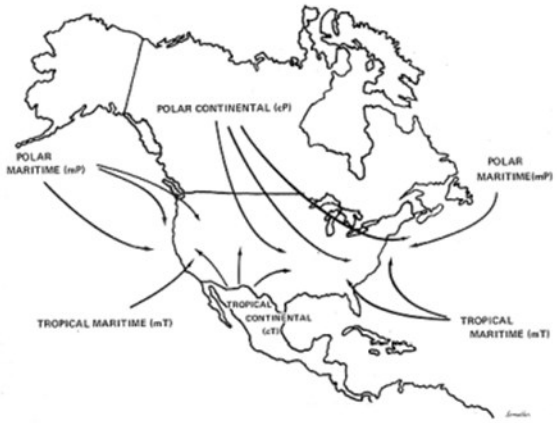


31. In the diagram, locations *A* and *B* on the map of North America are source regions for air masses. Compared to the air mass formed at location *B*, the air mass formed at location *A* will normally be?



a. cooler and drier
b. warmer and drier
c. cooler and wetter
d. warmer and wetter

32. Meteorologists classify air masses according to the general temperature and moisture of the region where they form. The terms 'maritime' and 'continental' refer to the amount of moisture in the region while the terms 'arctic' and 'tropical' refer to the general temperature of the region. The map below shows the general location of the typical air masses we see over North America. **Match the air mass name with the best description of its temperature and moisture.**



A. Cold and Dry B. Warm and Moist C. Cool and Moist D. Warm and Dry

_____ Maritime Polar Air mass

_____ Continental Polar or Arctic Air mass

_____ Maritime Tropical Air mass

_____ Continental Tropical Air mass

33. Explain the 3 factors in cloud / fog formation.

34. These "wispy" clouds are formed from ice crystals and are found in higher altitudes.

35. What type of clouds are towering clouds with anvil heads that bring thunderstorms?

a. Nimbostratus b. cirrocumulus c. cumulonimbus d. cirrus

36. A cumulus cloud is recognized mainly by its

a. obvious vertical dimension
b. darkness or color
c. precipitation
d. layered structure

37. T[illegible]cale where 0 degrees represents freezing and 100 degrees boiling is called:

[illegible]renheit
b. Cel[illegible]
Kelvin
d. [illegible]

38. What type of precipitation is associated with temperature inversion?

a. sleet b. freezing rain c. hail d. snow

39. What type of precipitation is associated with being a solid when it leaves a cloud and a solid when it hits the ground?

a. Sleet b. rain c. snow d. hail

40. Explain the other three(3) types of precipitation not reviewed in questions 39 and 40.

41. How do clouds impact temperature?