EARTH SCIENCE

UNIT 7 -KEY

METEOROLOGY

YOUR PLANET

YOUR INHERITANCE

YOUR LEGACY

UPDATED AND ADAPTED FROM DAVID J. MILLS 2001

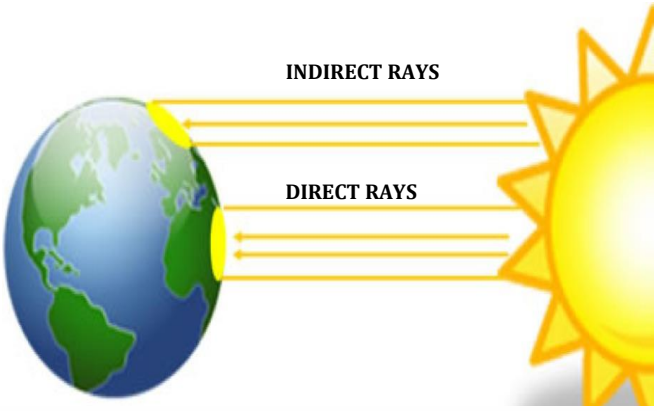
METEOROLOGY

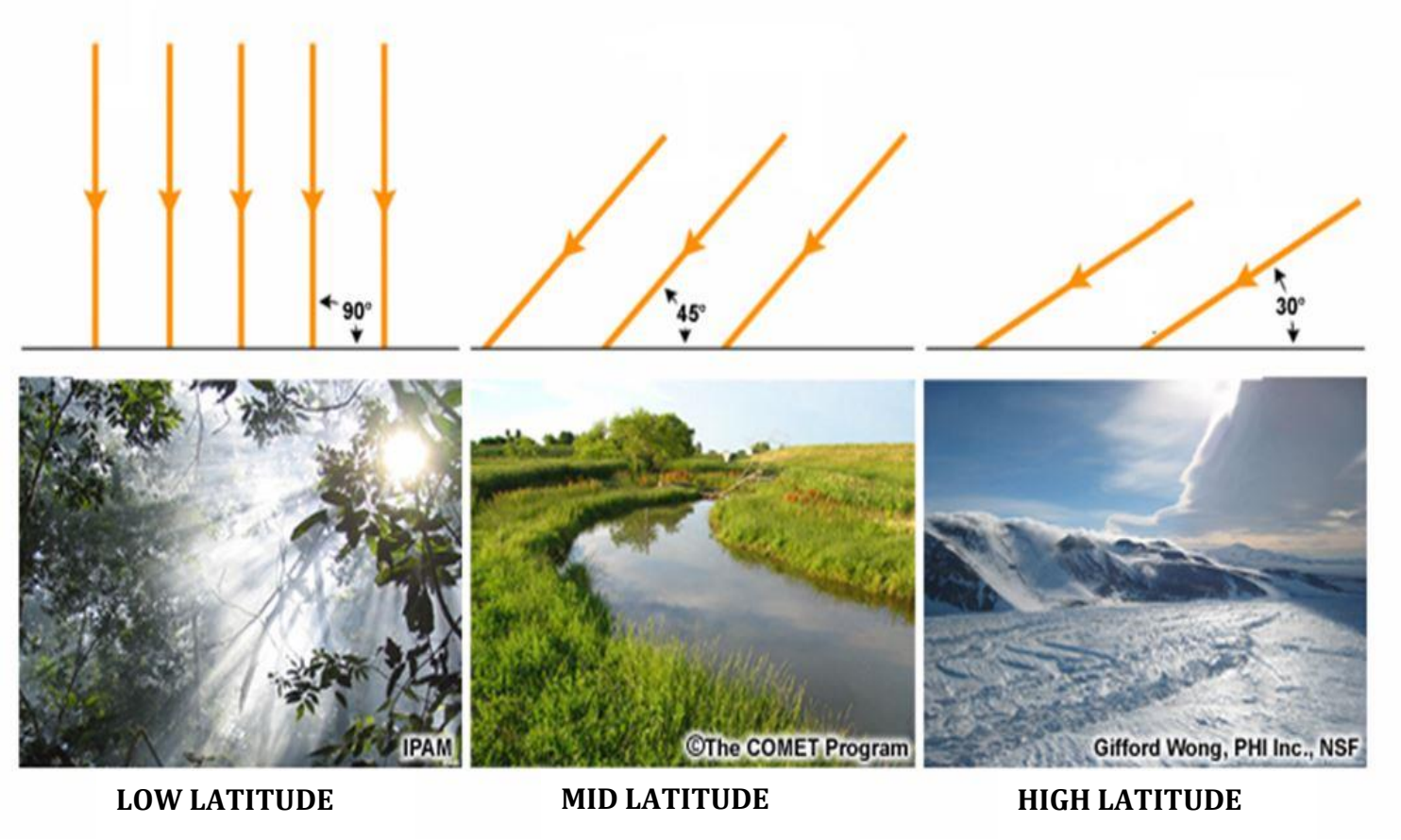
I. WEATHER: THE STATE OR CONDITION OF THE VARIABLES OF THE ATMOSPHERE FOR A LOCATION AT A GIVEN PERIOD.

a. CAUSES OF WEATHER:

i. Energy from the **SUN**.

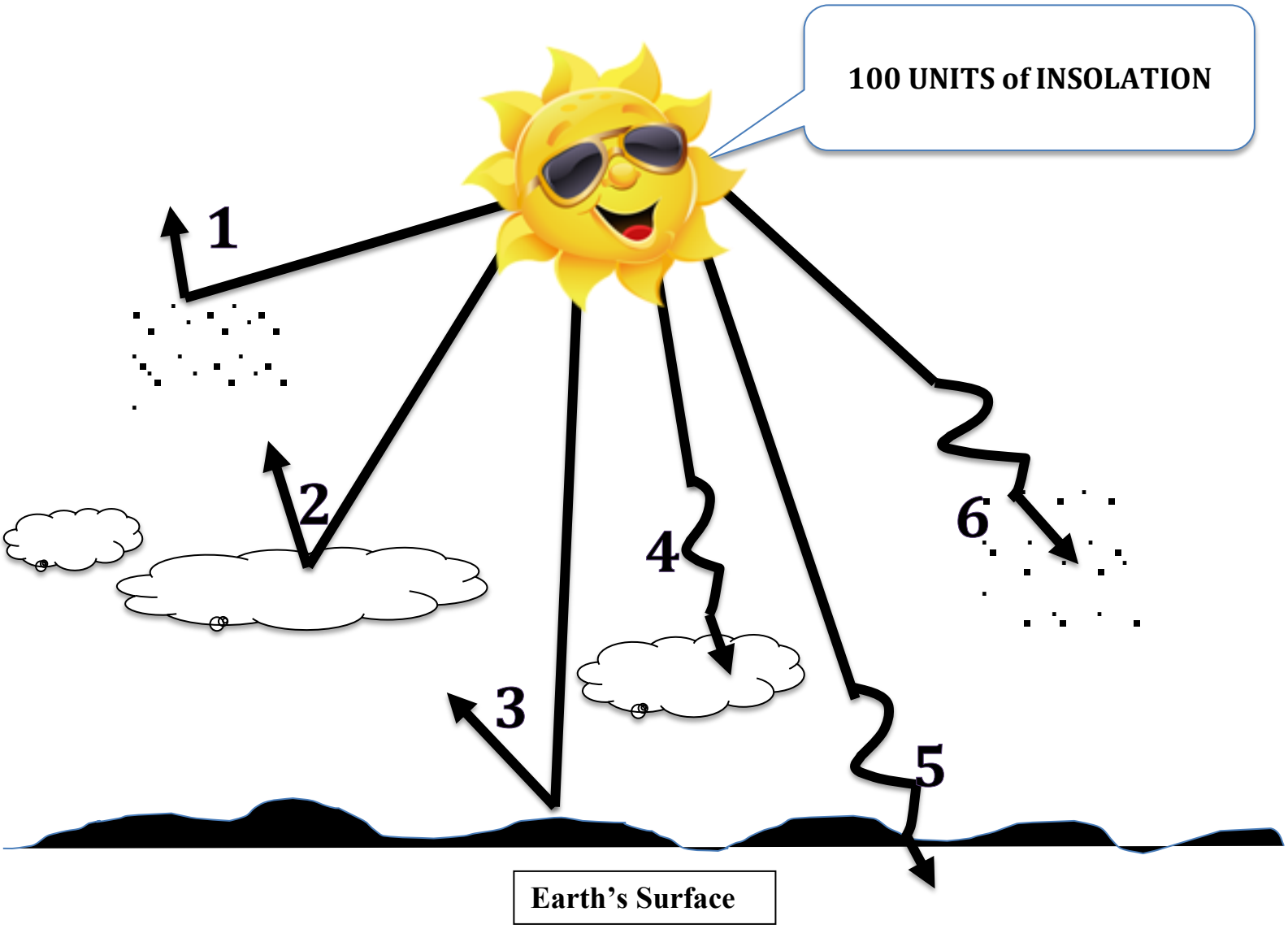
1. Through the seasons, the sun heats our world, some parts more and some less.





2. This **UNEVEN HEATING** causes earth's atmosphere to react and become a gigantic engine that produces an infinite variety of **WEATHER**.

b. The Atmosphere And Solar Energy



The diagram shows what happens to 100 units of sunlight entering Earth's atmosphere

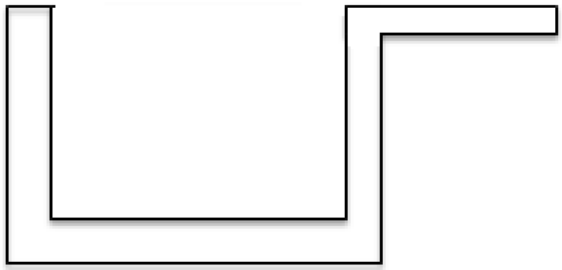
1	REFLECTED BY AEROSOLS (DUST PARTICLES, WATER DROPLETS)	6%
2	REFLECTED BY CLOUDS	20%
3	REFLECTED BY EARTH'S SURFACE	4%
4	ABSORBED BY CLOUDS	3%
5	ABSORBED BY EARTH'S SURFACE	51%
6	ABSORBED BY OZONE, WATER VAPOR, & DUST	16%

II. TEMPERATURE AND HEAT

a. **Heat Transfer**:

i.**CONDUCTION**:

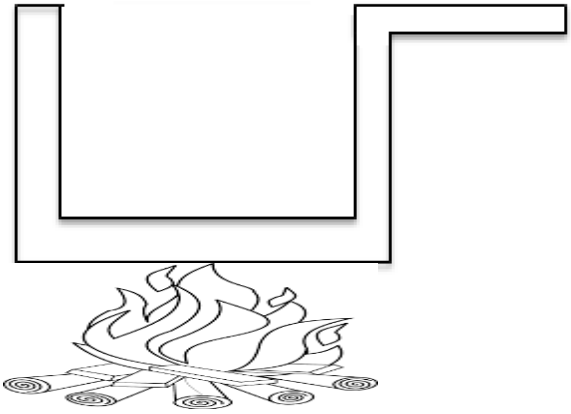
The flame's heat causes molecules in the pan's bottom to vibrate faster, making it hotter. These vibrating molecules collide with their neighboring molecules, making them vibrate faster too. After a while, molecules in the pan's handle are vibrating so fast that it is too hot to touch.



CONDUCTION IS: **THE TRANSFER OF HEAT BY THE COLLISION OF MOLECULES. CONDUCTION OCCURS BEST IN SOLIDS BECAUSE MOLECULES ARE CLOSER TOGETHER (SOLIDS ARE MORE DENSE)**

ii. **CONVECTION:**

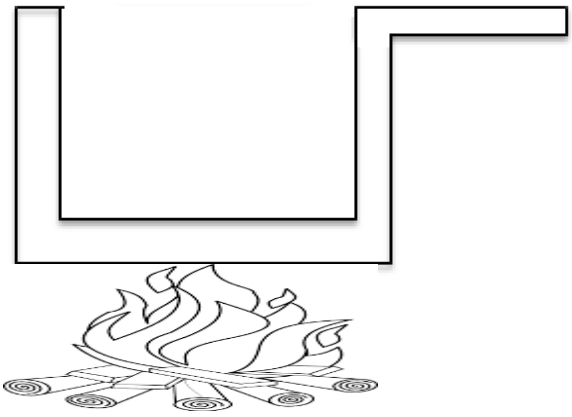
The heat in the pan, especially near the flame, causes the molecules of water at the bottom of the pan to vibrate faster, making it hotter. This hotter water becomes less dense and rises. Surrounding cooler, more dense water sinks to replace it. A circular pattern of movement develops within the water. This up and down movement eventually heats all of the water.



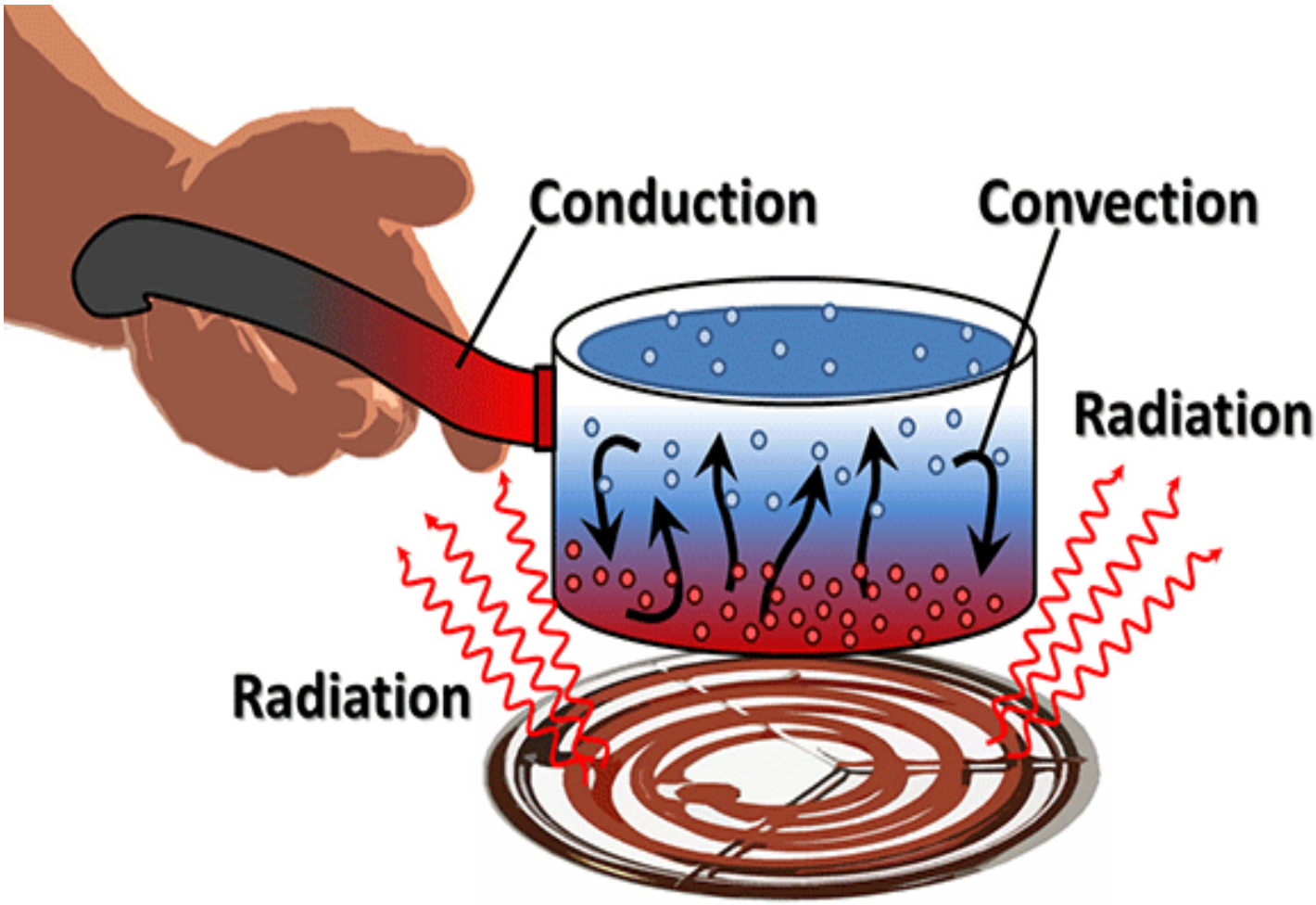
CONVECTION IS: **THE TRANSFER OF HEAT BY THE ACTUAL MOVEMENT OF THE HEATED FLUID (GAS OR LIQUID)**

iii. **RADIATION**:

The heat in the pan radiates heat in the form of waves to the surrounding air. (Air is a poor conductor of heat.) Heat, light, and other kinds of waves radiate through the near vacuum of outer space from the from the sun to Earth.

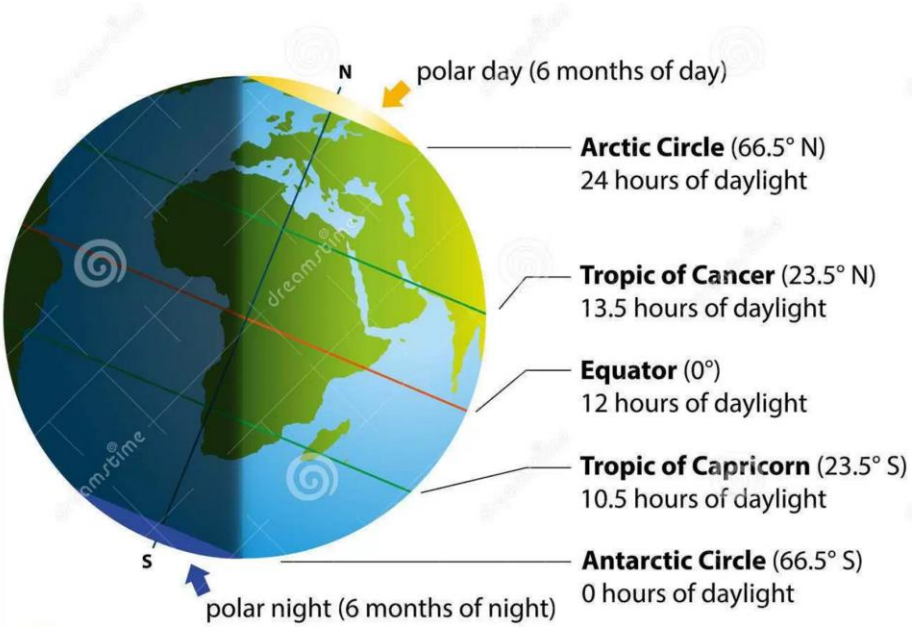


RADIATION IS: **THE TRANSFER OF HEAT BY WAVE MOTION, THROUGH AIR (TRANSPARENT MATERIAL) OR A VACUUM (SPACE).**



III. FACTORS THAT AFFECT THE AMOUNT / RATE OF HEATING.

a.



ANGLE
and
DURATION
of Insolation

b. LAND and WATER

LAND HEATS UP AND COOLS DOWN FASTER THAN WATER

c. COLOR

vs

DARK COLORS HEAT FASTER THAN LIGHT COLORS

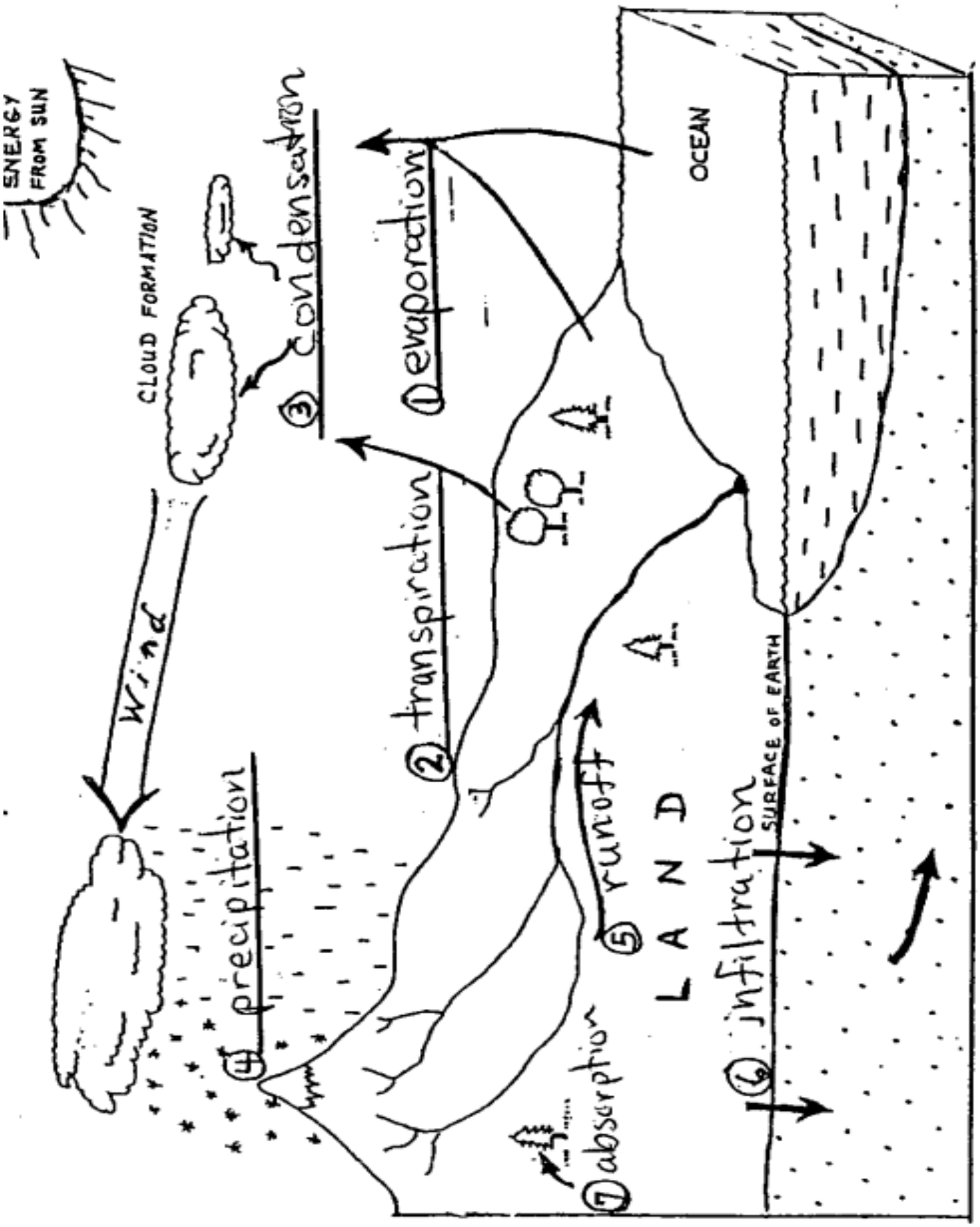
d. TEXTURE

vs

ROUGH TEXTURES HEAT FASTER THAN SMOOTH TEXTURES

IV. MOISTURE

a. The Water Cycle



8. The primary source of energy for the water cycle is the **SUN**.

9. **TRANSPIRATION** is the process by which plants release water into the atmosphere. (#2 in the diagram.)

10. **PRECIPITATION** is falling liquid or solid water from clouds to earth's surface. (#4 in the diagram). Examples:
    a. **RAIN**
    b. **SNOW**
    c. **HAIL**
    d. **SLEET**

b. Changes in State
   i. **Evaporation**: **LIQUID CHANGING INTO A GAS**
      1. It requires **2260 JOULES** of energy to convert **1 GRAM** of **LIQUID WATER TO WATER VAPOR.**

      2. **Evaporation is a COOLING process since it absorbs heat from the environment.**

   ii. **Condensation**: Water vapor changing into a liquid
      1. Water molecules **RELEASE** energy equivalent to what was absorbed during evaporation (**2260 JOULES**).

      2. Condensation in the atmosphere results in the formation of **CLOUDS** and **DEW / FOG / FROST**.

   iii. **Melting**: **SOLID CHANGING TO A LIQUID**
      1. It requires **334 JOULES** of energy/heat to convert **1 GRAM of ICE TO A LIQUID**.

      2. Melting is a **COOLING** process since is absorbs heat from the environment.

   iv. **Freezing**: Liquid changing into a solid
      1. Water molecules RELEASE energy equivalent to what was absorbed during melting (**334 JOULES)**

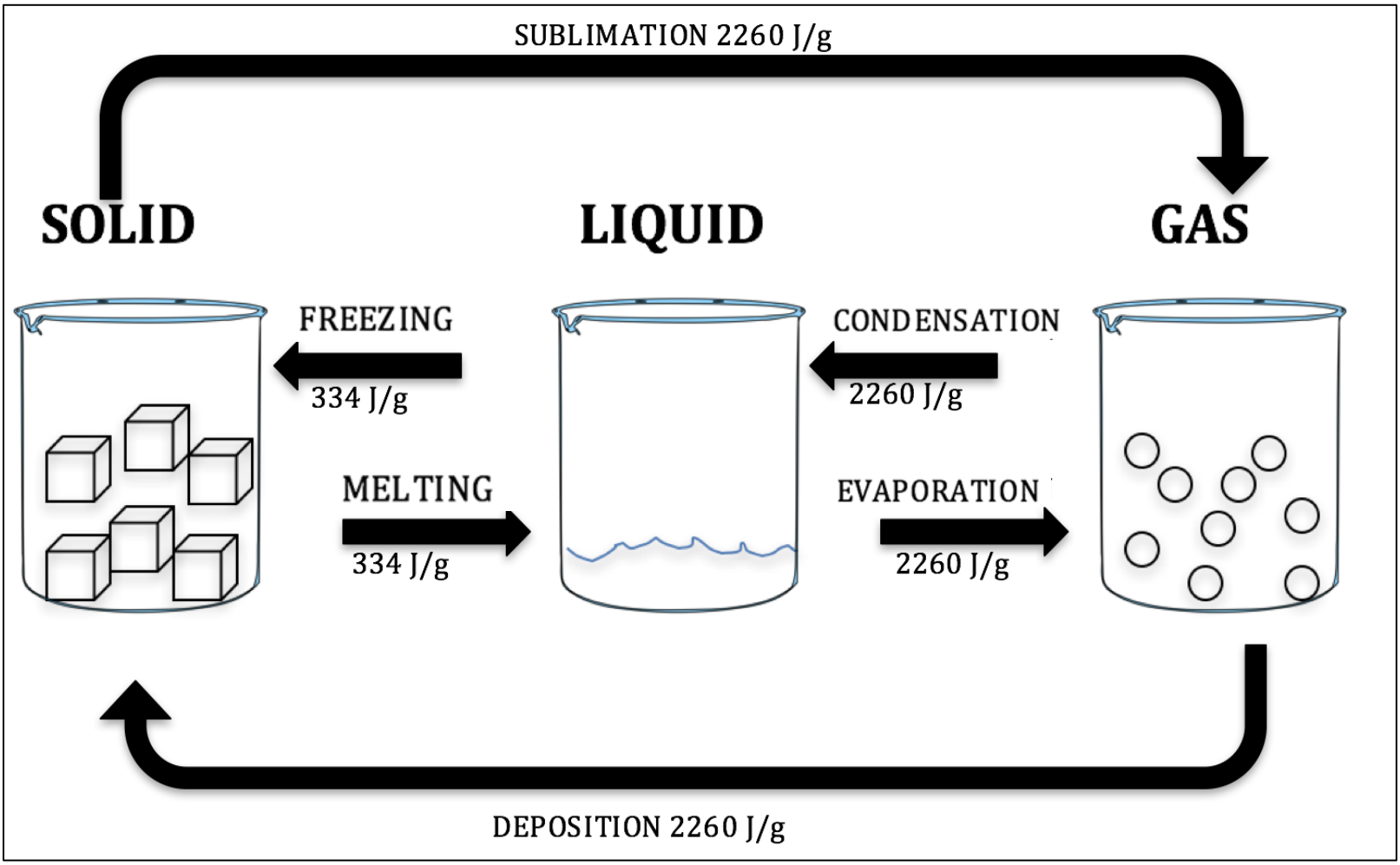
v. **Sublimation**: **SOLID CHANGING DIRECTLY TO GAS** (skipping the liquid stage)

vi.

1. Examples: **MOTH BALLS** AND **DRY ICE**

vii. **Deposition**: **GAS CHANGING DIRECTLY TO A SOLID** (skipping the liquid stage)

viii. **DIAGRAM**



c. **WEATHER / ATMOSPHERIC VARIABLES**

i. **TEMPERATURE**
ii. **WIND (SPEED AND DIRECTION)**
iii. **MOISTURE (PRECIPITATION & HUMIDITY)**
iv. **AIR PRESURE**

d. WEATHER INSTRUMENTS

BAROMETER

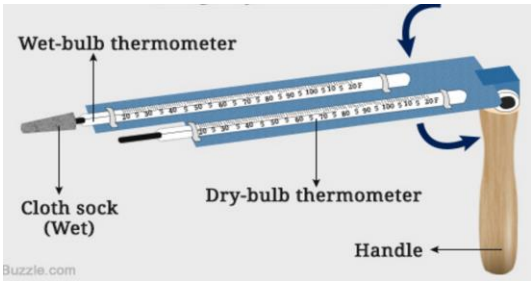
MEASURES: AIR PRESSURE

UNITS: MILLIBARS (mb)

RAIN GUAGE

MEASURES: RAINFALL

UNITS: INCHES (in)



SLING PSYCHROMETER

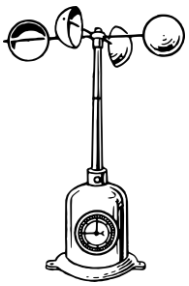
MEASURES: RELATIVE HUMIDITY

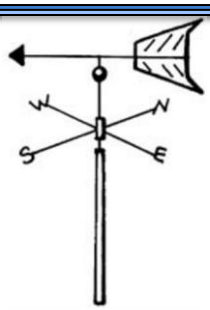
UNITS: PERCENT (%)

ANEMOMETER

MEASURES: WIND SPEED

UNITS: KNOTS



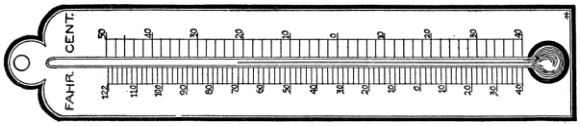


WIND / WEATHER VANE

MEASURES: WIND DIRECTION

THERMOMETER

MEASURES: TEMPERATURE



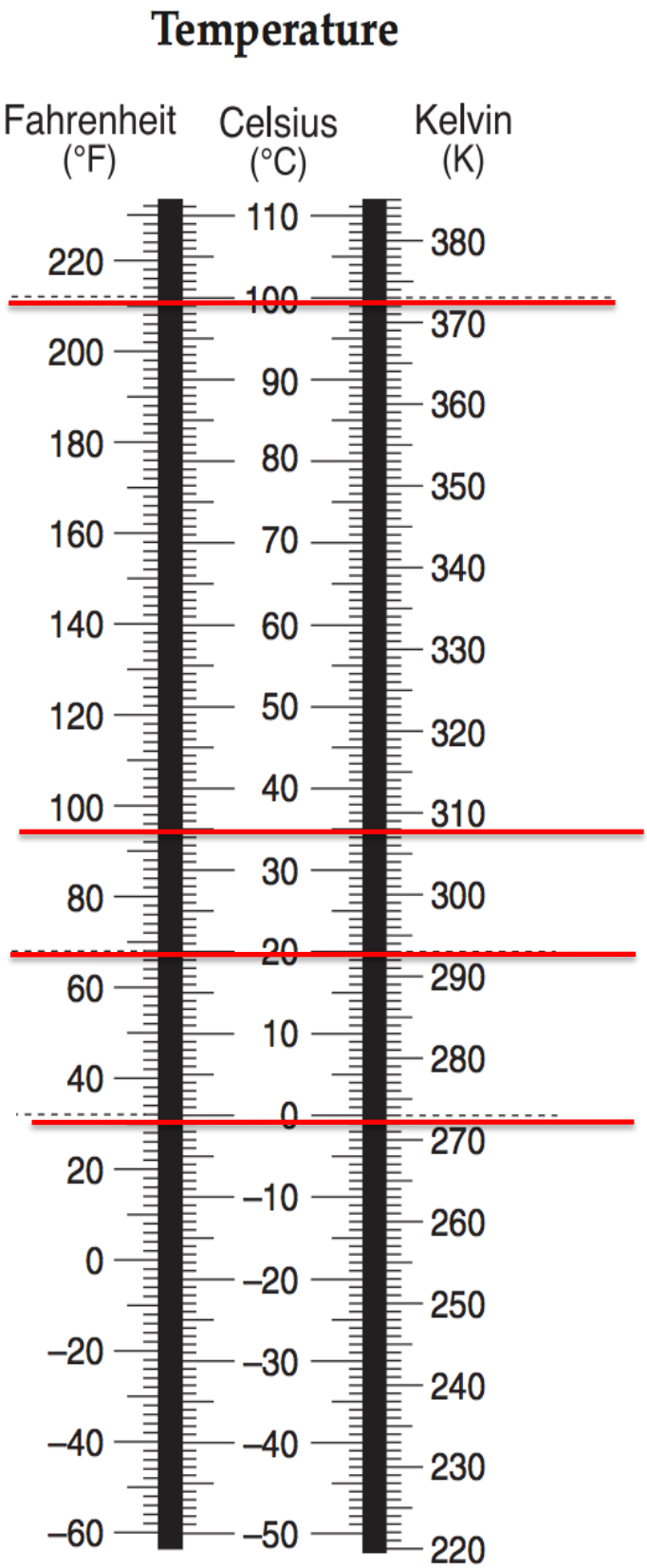
e. **Measuring Temperature**

WATER BOILS **212** ^{0}F **100** ^{0}C

BODY TEMPERATURE **98** ^{0}F **37** ^{0}C

ROOM TEMP **68 / 64** ^{0}F **20 / 21** ^{0}C

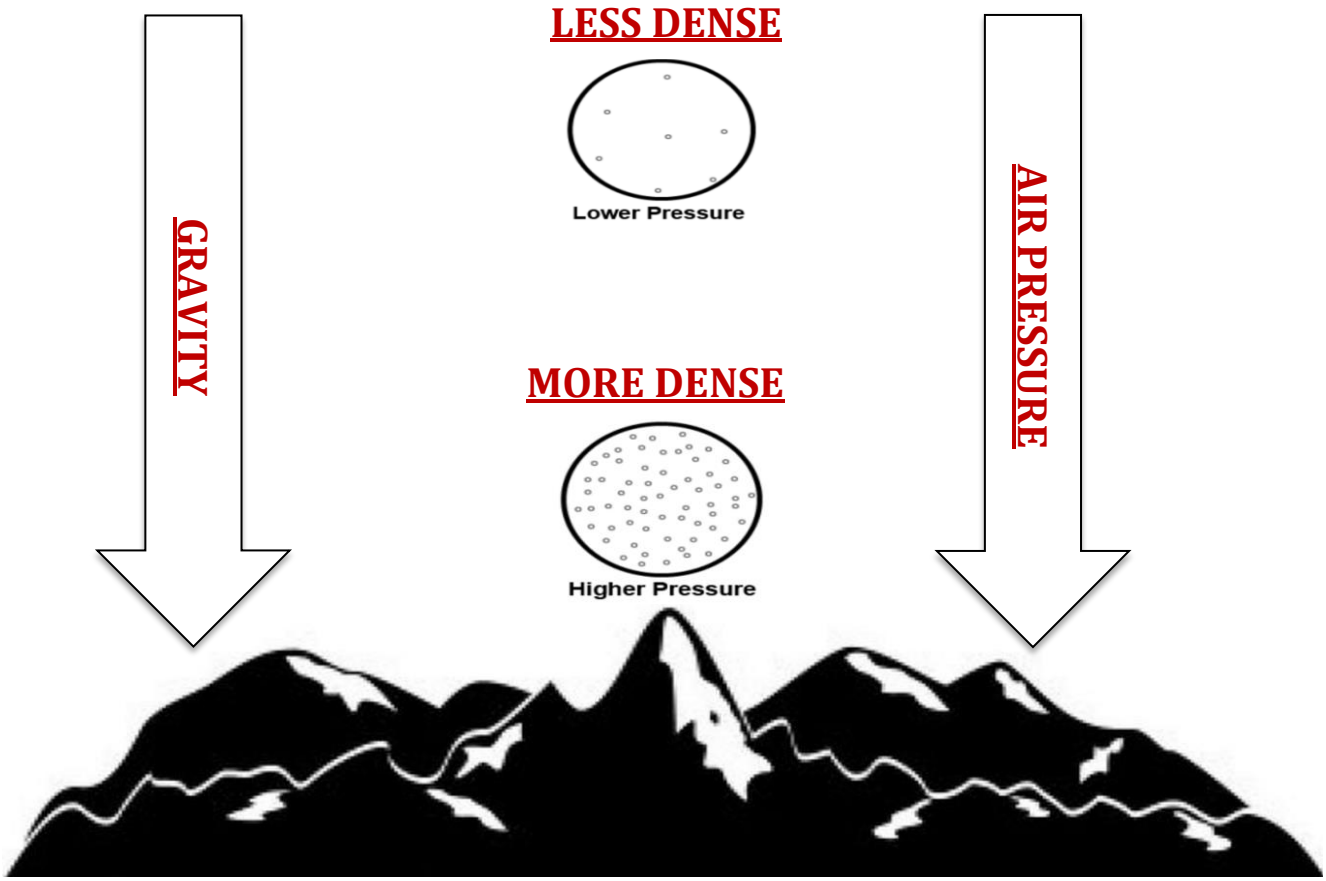
WATER FREEZES **32** ^{0}F **0** ^{0}C



V. AIR PRESSURE

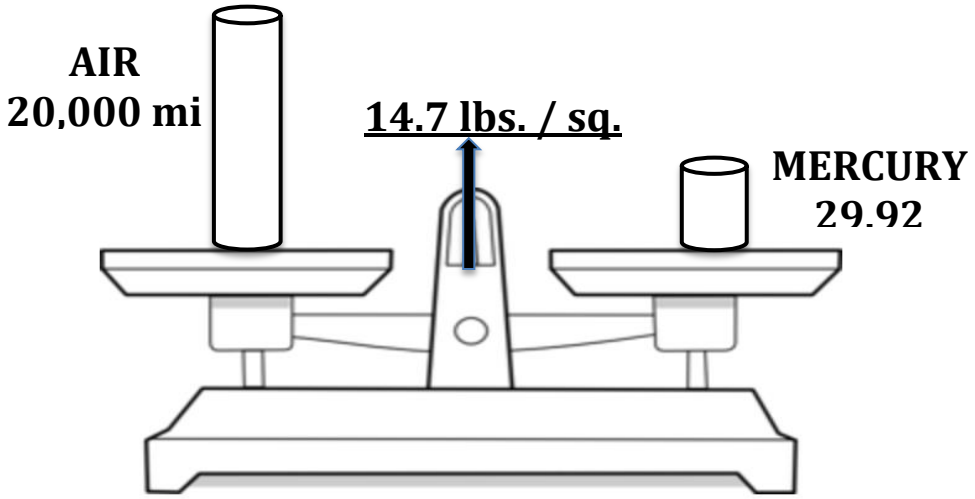
a. Causes of Air Pressure:

i. **The force of GRAVITY causes the air to have WEIGHT – this creates air pressure.**



ii. **Air pressure acts equally IN ALL DIRECTIONS; it also exists within any object containing air like a building, the human body, and "empty" bottles.**

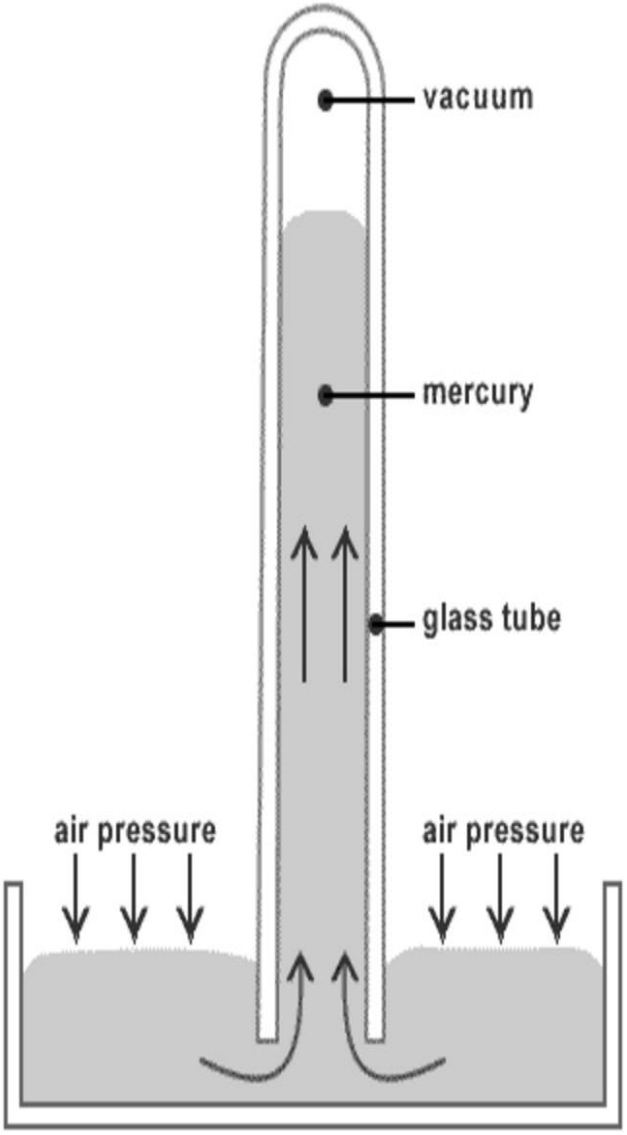
iii.



iv. Air pressure at sea level is **14.7 lb./in²**

b. **Measuring Air Pressure**

MERCURY Barometer



ANEROID Barometer

An aneroid barometer consists of an air tight metal box from which most of the air has been removed.

A change in air pressure causes a small metal disk on the side or top to bend. A spring is attached to the metal disk. The bending of the metal disk causes the spring to move. A needle attached to the spring moves to indicate the changing air pressure on the dial

Units for measuring air pressure:

MERCURY BAROMETER

INCHES (OF MERCURY)

ANEROID BAROMETER

MILLIBARS (MB)

c. **Atmospheric Pressure Scale (ESRT Page 13)**

i. **Standard sea level atmospheric pressure is:**

ONE ATMOSPHERE or 29.92 IN. or 1013.2 MB

ii. **Conversions:**

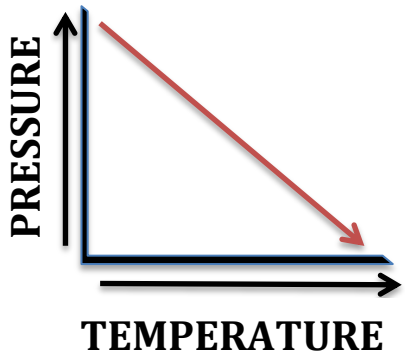
1. **997.0 mb. = 29.44 in.**
2. **1021.0 mb. = 30.15 in.**
3. **1006.0 mb. = 29.71 in.**
4. **982.0 mb. = 29.00 in.**
5. **1000.0 mb. = 29.53 in.**
6. **1023.0 mb. = 30.21 in.**
7. **1019.0 mb = 30.09 in.**

d. **Changes in atmospheric pressure**

i. Factors / variables that cause atmospheric pressure to change:
(a) **TEMPERATURE**
(b) **MOISTURE**
(c) **ALTITUDE**

ii. Effect of **TEMPERATURE** on air pressure:

AS AIR TEMPERATURE INCREASES, (AIR MOLECULES MOVE FARTHER APART / BECOME LESS DENSE) THE AIR PRESSURE DECREASES.



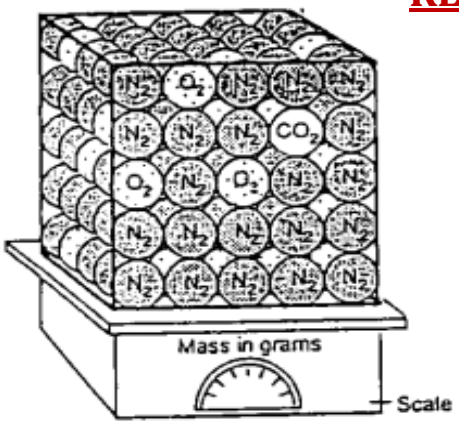
iii. Effect of **MOISTURE** on air pressure:

a. The diagrams represent a specific volume of air in three different circumstances. They show how the density or mass of this volume of air changes when water vapor enters the air.

DATA TABLE

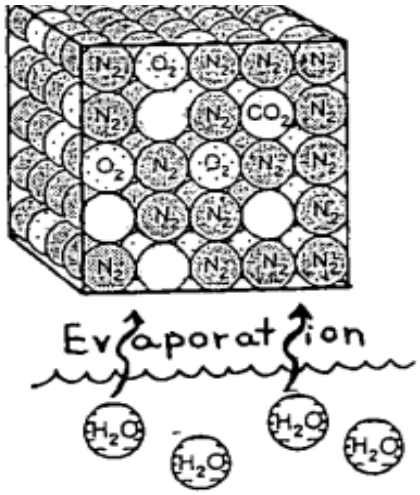
Molecule Symbol	Gas	Mass
N_2	Nitrogen	28 g
O_2	Oxygen	32 g
CO_2	Carbon Dioxide	44 g
H_2O	Water Vapor	18 g

1. DRY

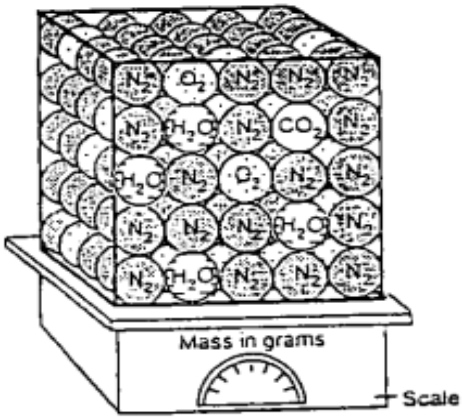


MORE DENSE

2. WATER VAPOR REPLACE AIR MOLECULES

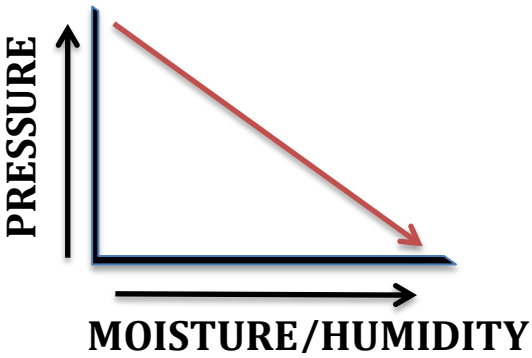


3. HUMID



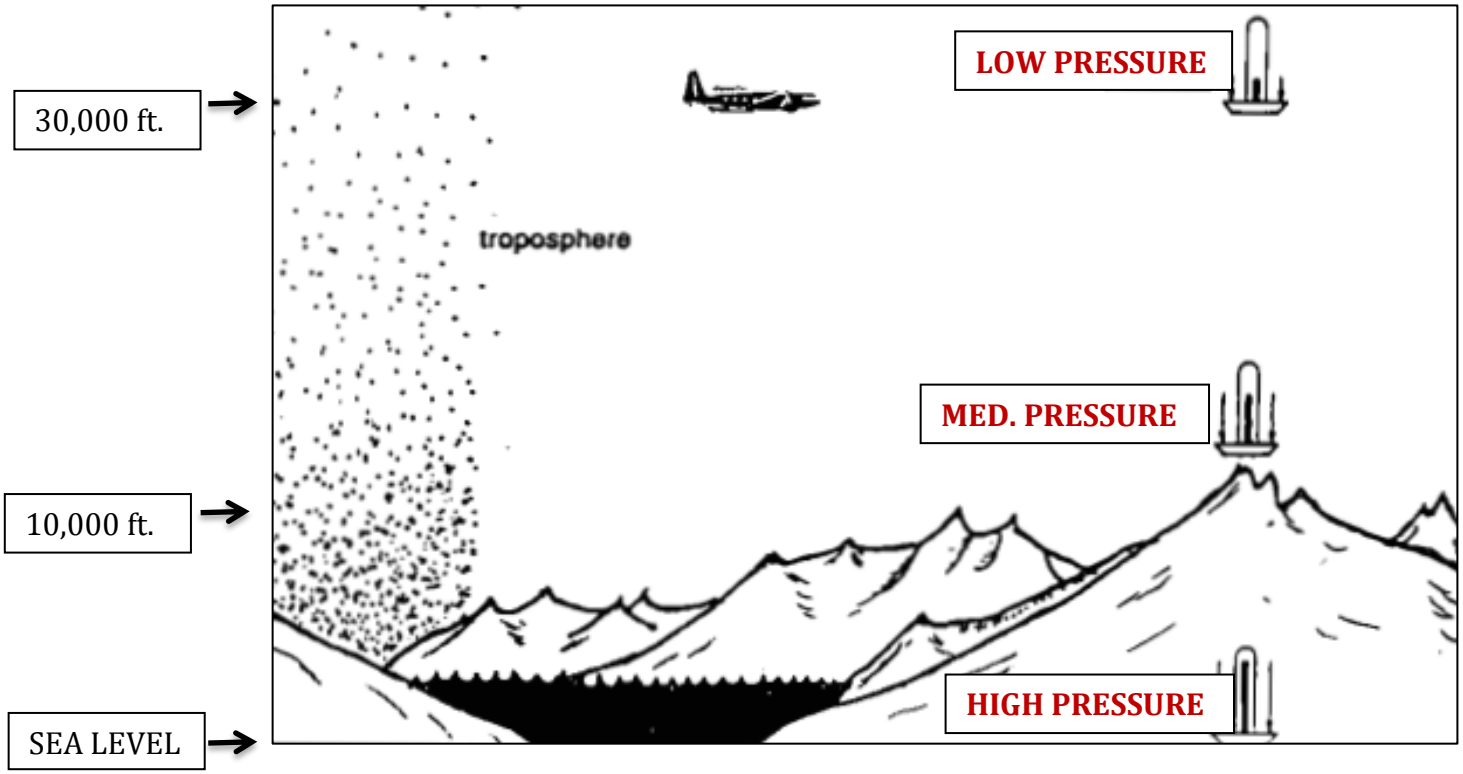
LESS DENSE

b. As humidity increases, AIR **PRESSURE DECREASES – BECAUSE WHEN WATER VAPOR MOLECULES ENTER THE AIR, THEY REPLACE HEAVIER AIR MOLECULES**.

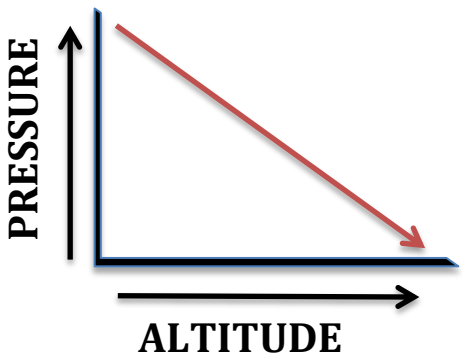


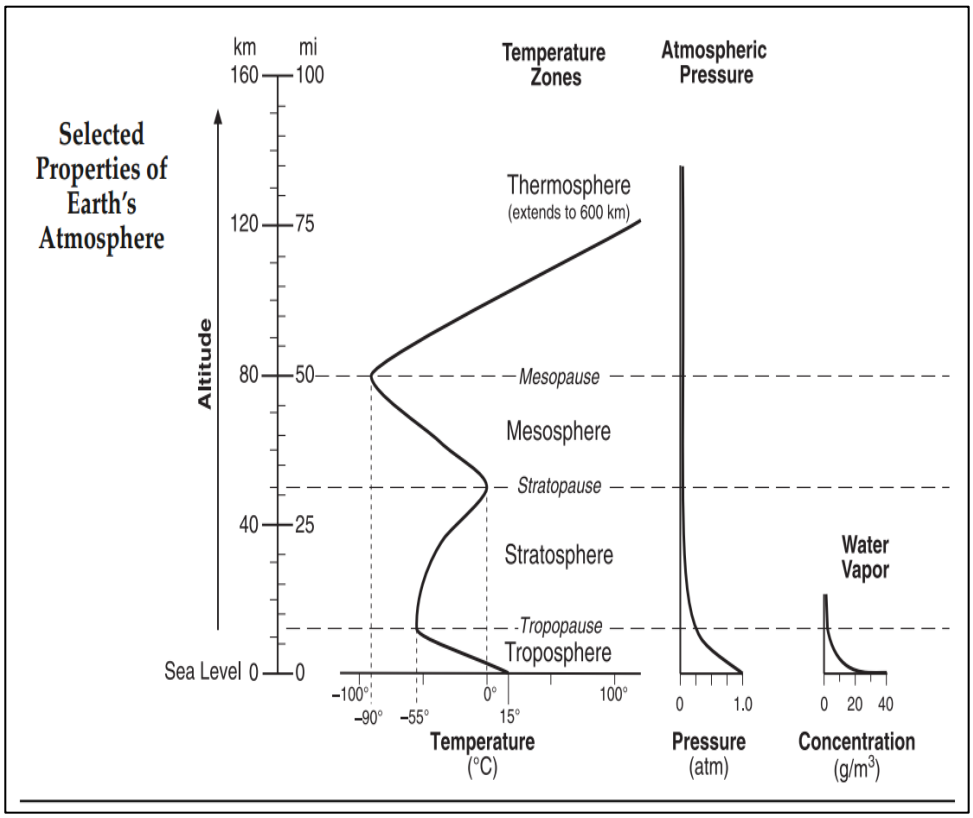
iv. Effect of **ALTITUDE** on air pressure:

1.



2. **AS ALTITUDE INCREASES, AIR PRESSURE DECREASES. (LESS AIR IS ABOVE AND AIR IS LESS DENSE)**.





VI. WIND- THE HORIZONTAL MOVEMENT OF AIR PARALLEL TO THE EARTH'S SURFACE.

a. Causes of wind (what makes the wind blow?)

i. UNEVEN HEATING OF THE EARTH'S SURFACE

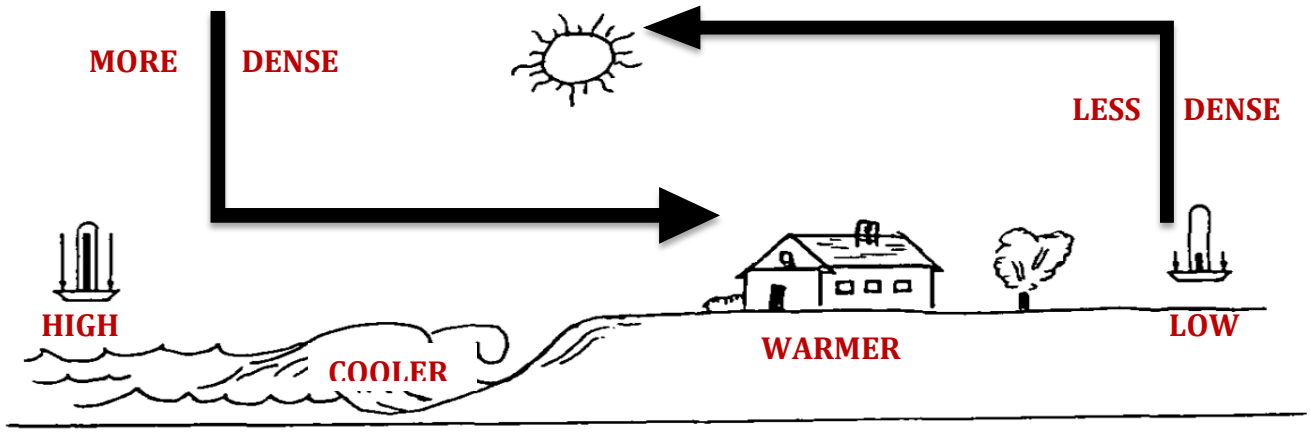
ii. Examples:

1. LAND vs WATER
2. POLES vs EQUATOR
3. DARK FOREST vs SNOW FIELD

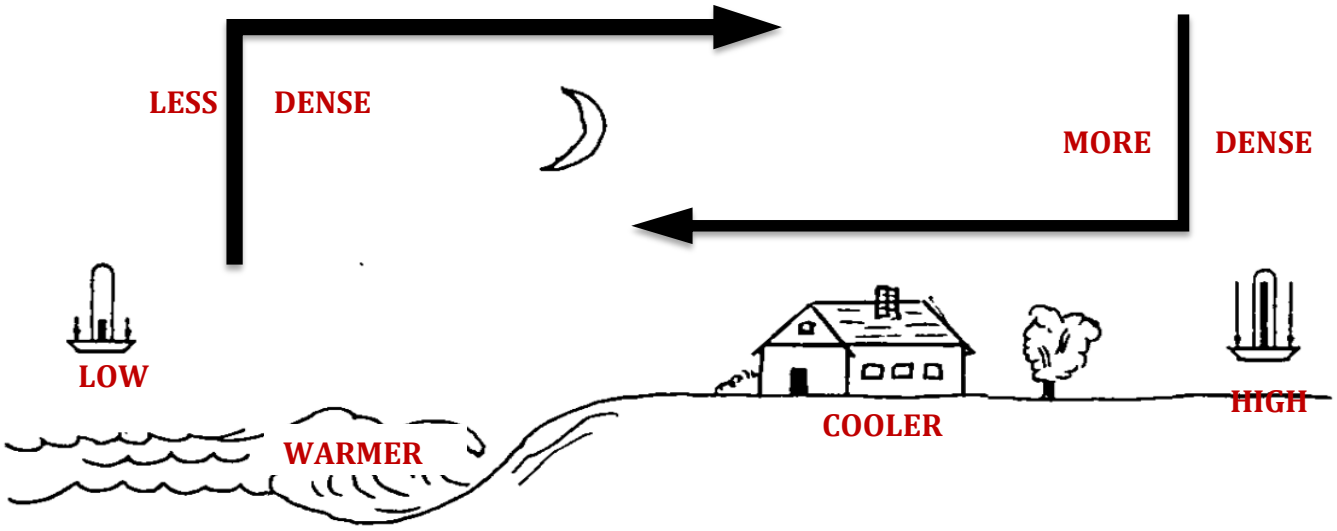
iii. Wind helps to distribute energy from regions of surplus energy (too much) to regions of energy deficit (too little).

b. Sea Breeze / Land Breeze

1. SEA **Breeze**: AIR OVER LAND IS WARM AND RISES, PULLING COOLER AIR FROM OVER THE WATER IN TO REPLACE IT. COOL BREEZE FLOWS FROM WATER TO THE LAND



2. LAND **Breeze**: AIR OVER WATER IS WARMER AND RISES, PULLING COOLER AIR FROM OVER THE LAND IN TO REPLACE IT. COOL BREEZE FLOWS FROM LAND OUT TO SEA.

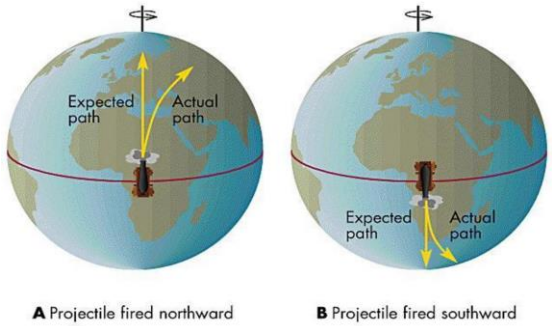


c. Wind Direction

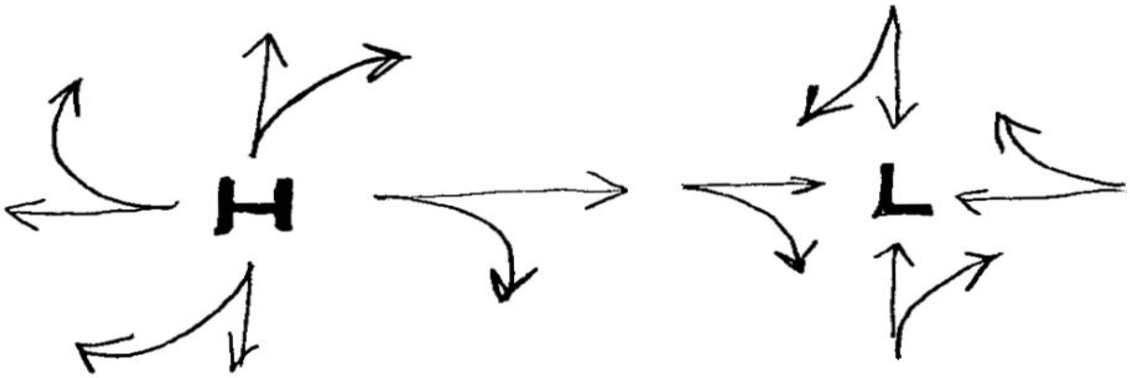
i. Wind always blows from regions of **HIGH** pressure to regions of **LOW** pressure.

ii. The Coriolis Effect – Earth's **ROTATION** on its axis causes winds to be deflected to the **RIGHT** in the **NORTHERN** hemisphere and to the **LEFT** in the **SOUTHERN** hemisphere.

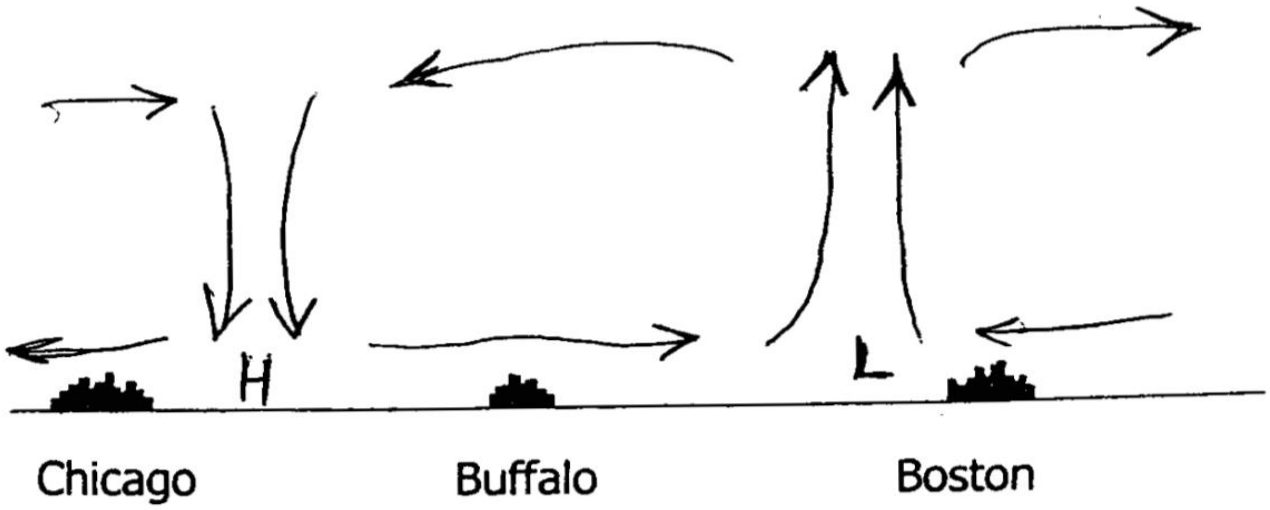
iii. Globe View:



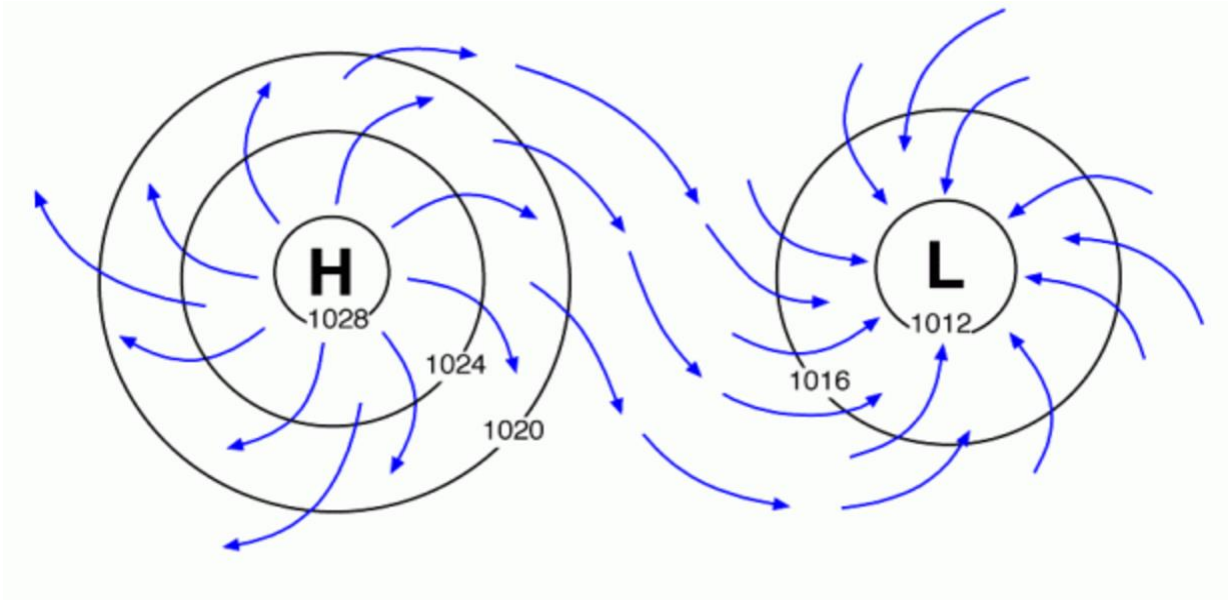
iv. Map View:



v. Side / Profile View



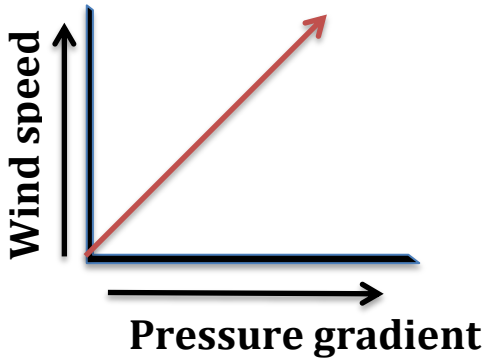
vi. Cyclones and Anticyclones

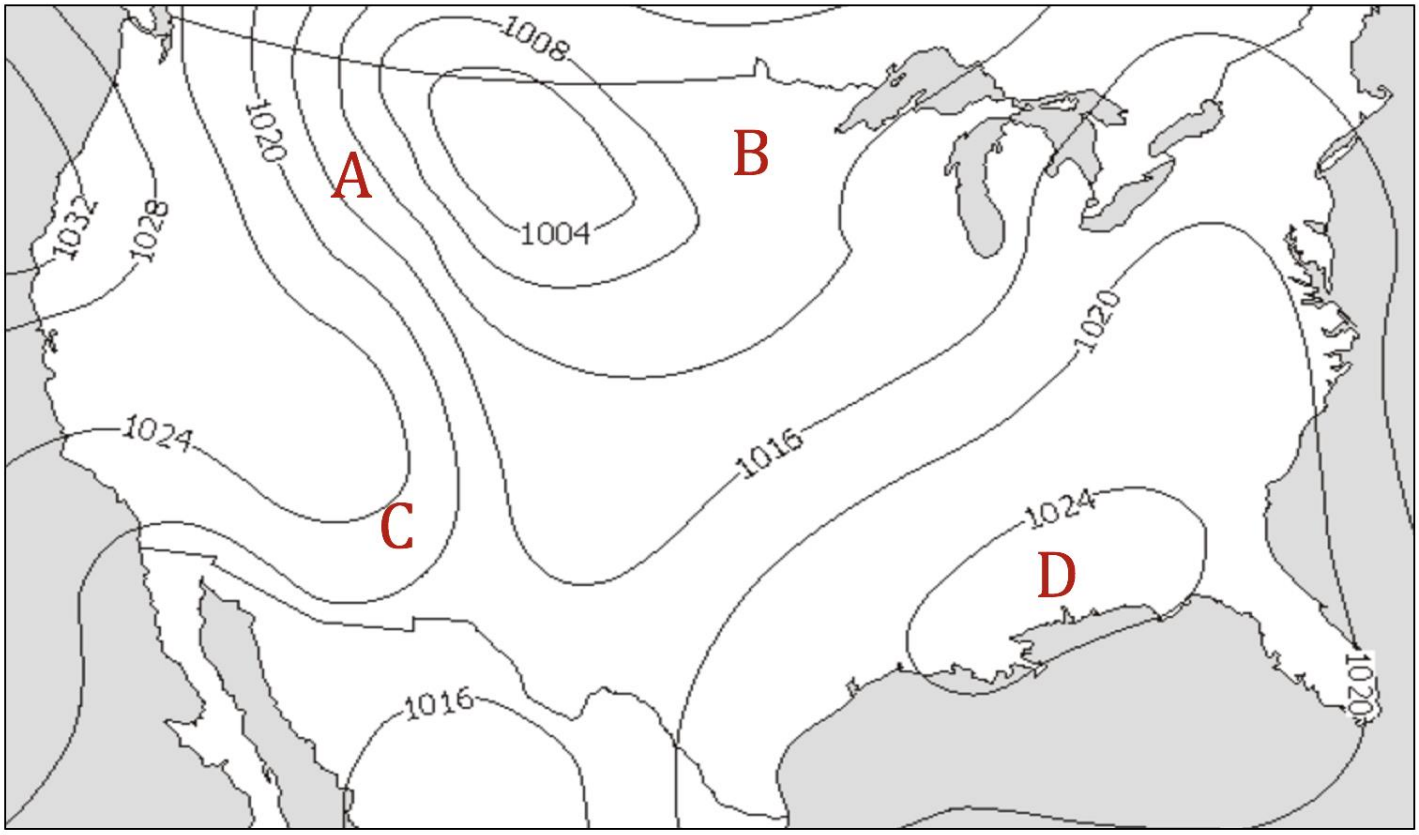


CLOCKWISE AND OUT **COUNTER CLOCKWISE AND IN**

vii. Winds move in a clockwise, outward spiral around a **HIGH PRESSURE SYSTEM**.
viii. Winds move in a counterclockwise, inward spiral around a **LOW-PRESSURE SYSTEM**.

d. Wind Speed
   i. The speed of the wind is determined by the **DIFFERENCE IN AIR PRESSURE**
   ii. Pressure Gradient – **DIFFERENCE IN AIR PRESSURE BETWEEN TWO PLACES**
   iii. As the pressure gradient **INCREASES**, wind speed **INCREASES**.





i. Where is the pressure gradient the greatest? **A**

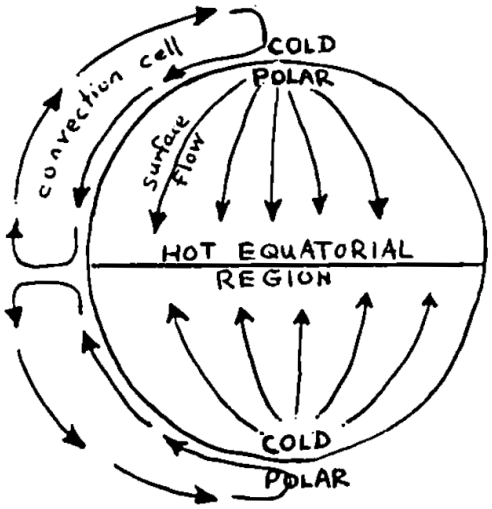
ii. Where are the winds the strongest? **A**

e. Global Winds

The unequal distribution of solar energy (insolation), in terms of both intensity and duration, causes unequal heating of earth. Differences in temperature cause differences in pressure which result in winds.

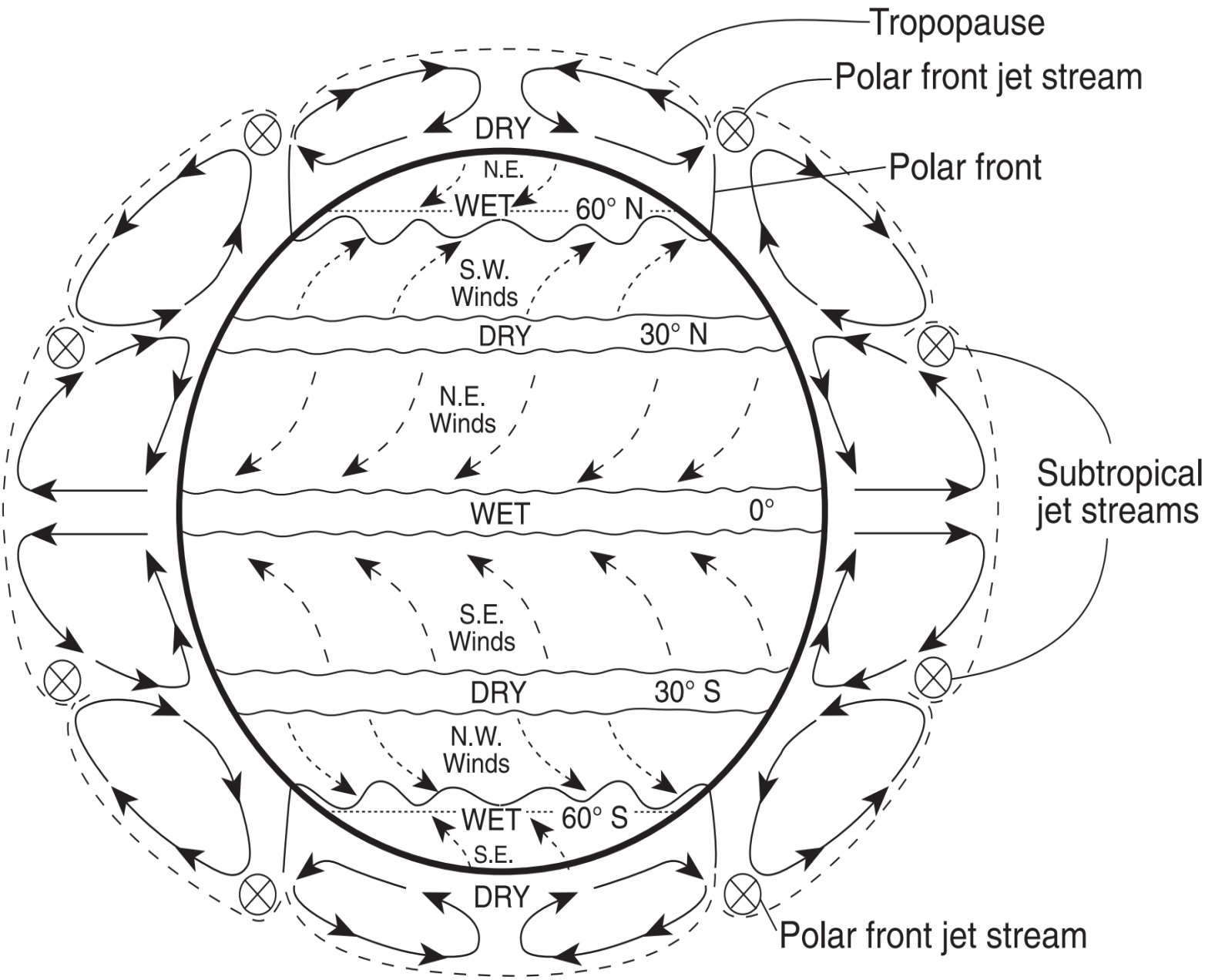
Cooler air, being denser, sinks toward earth due to gravity/ This causes warmer, less dense air to rise.

Global winds, or circulation, on a **NON-ROTATING** earth.



Earth's rotation causes the "Coriolis Effect" which results in the three (or six) cell circulation of winds as illustrated on the next page.

ESRT Page 14


Tropopause
Polar front jet stream
Polar front
DRY
N.E.
WET
60° N
S.W.
Winds
DRY
30° N
N.E.
Winds
WET
0°
S.E.
Winds
DRY
30° S
N.W.
Winds
WET
60° S
S.E.
DRY
Subtropical
jet streams
Polar front jet stream

VII. Moisture in the Atmosphere

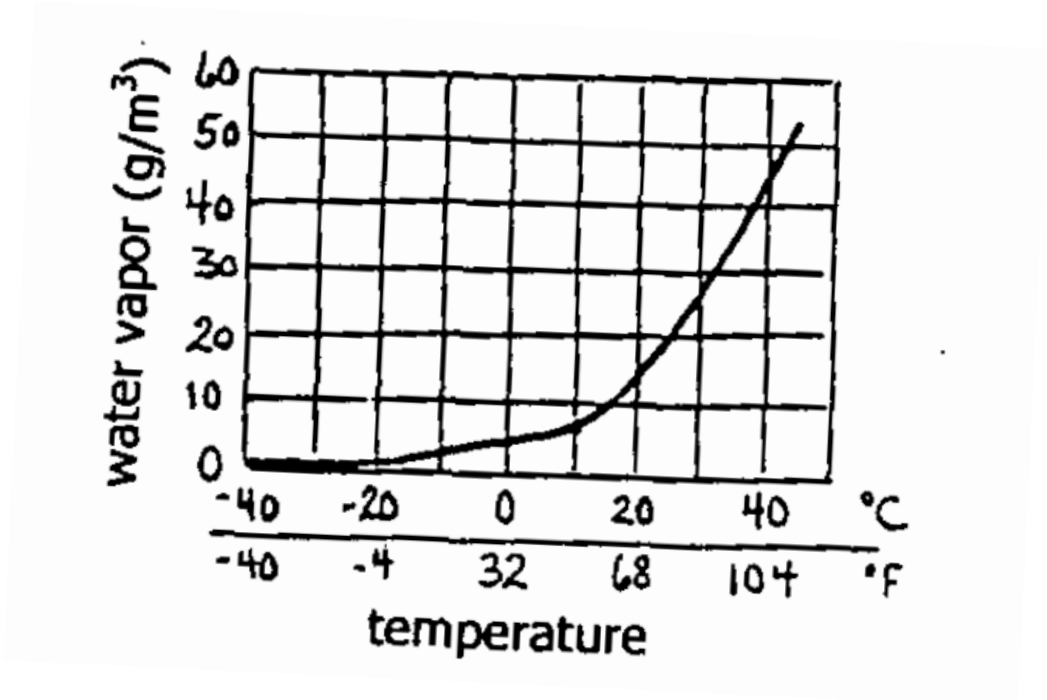
a. The primary source of moisture in the atmosphere is the **OCEAN**.

Other sources include:
LAKES, RIVERS, SOIL, PLANTS

b. Moisture in the atmosphere exists in all three states / phases
   i. **GAS** – Known as water vapor
   ii. **LIQUID** – Tiny droplets suspended in the air that form clouds
   iii. **SOLID** – Tiny crystals suspended in the air that form clouds.

c. **HUMIDITY** is the general term used to describe **THE AMOUNT OF WATER VAPOR IN THE AIR**.

d. **Temperature** determines the amount of water vapor the air can hold.
   i. .

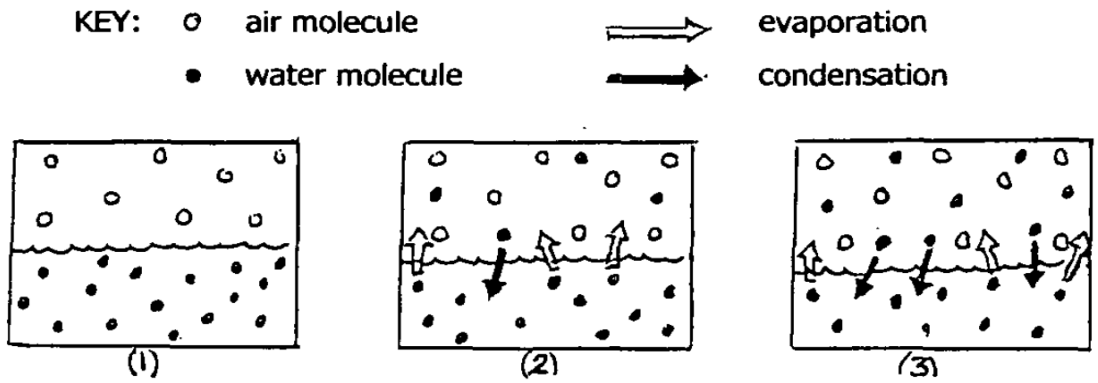


   ii. As air temperature **INCREASES**, the amount of water vapor the air can hold **INCREASES**

   iii. At 35^{0}C, a cubic meter of air can hold **35 GRAMS** of water vapor

iv. **SATURATION**: when air holds as much water vapor as it can at a certain temperature.

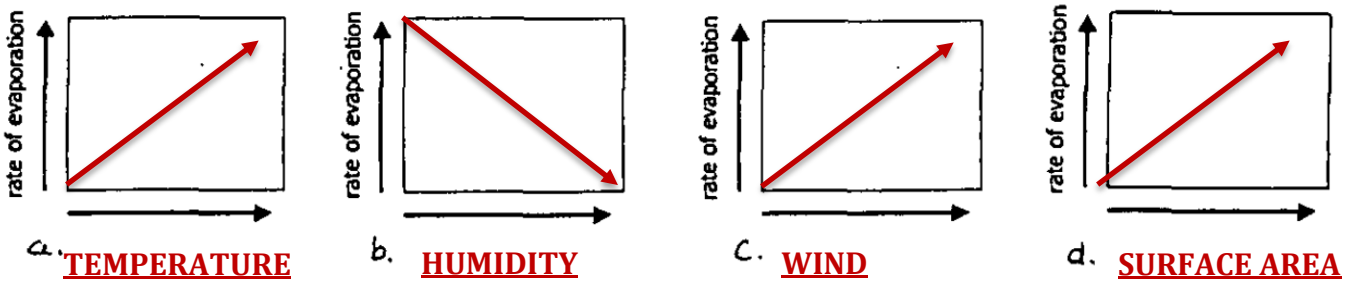
v. **SATURATION OCCURS WHEN EVAPORATION = CONDENSATION**



1. At (1), no **EVAPORATION** has occurred.
2. At (2), **EVAPORATION** is proceeding faster than **CONDENSATION**
3. At (3), the rate of **EVAPORATION** equals the rate of **CONDENSATION**. **EQUILIBRIUM** has been reached and the air is **SATURATED**.

vi. Factors affecting the Rate of Evaporation:

1. **TEMPERATURE** – **AS TEMPERATURE INCREASES, RATE OF EVAPORATION INCREASES**
2. **HUMIDITY** – **AS HUMIDITY INCREASES, RATE OF EVAPORATION DECREASES.**
3. **WIND** – **AS WIND INCREASES, RATE OF EVAPORATION INCREASES**.
4. **SURFACE AREA** – **AS SURFACE AREA INCREASES, RATE OF EVAPORATION INCREASE**



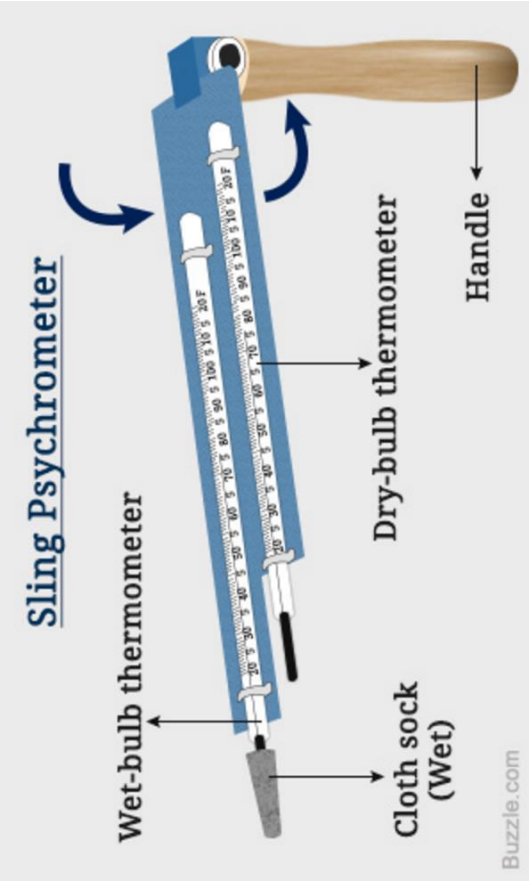
VIII. DEW POINT TEMPERATURE – THE TEMPERATURE TO WHICH THE AIR MUST BE COOLED TO REACH SATURATION.

a. Using A Sling Psychrometers To Measure Dew Point Temperature.

A sling psychrometers consists of two thermometers mounted on a narrow frame which has a handle used to whirl the thermometer. One thermometer always remains dry (the dry bulb). The other thermometer has a cloth sock or "wick" over its bulb that is moistened before it is used (the wet bulb).

After the psychrometers is whirled around for a little less than one minute, both thermometers are read.

Evaporation of water from the moistened wick will have lowered the temperature reading on the wet bulb thermometer (if the air is not saturated). Remember: evaporation absorbs heat and is a cooling process.



b. The **DRIER** the air, the **FASTER / MORE** evaporation will occur, resulting in **GREATER / MORE** cooling. Therefore, the difference in temperature between the dry bulb and wet bulb thermometer will be **GREATER/ MORE**.

c. The more **HUMID** the air, the **LESS** evaporation will occur, resulting in **LESS** cooling of the wet bulb thermometer. Therefore, the difference in temperature between the dry bulb and wet bulb will be **SMALLER**.

d. At saturation, the temperature difference between the dry and wet bulbs would be **0**.

ESRT PAGE 12: DETERMINING DEW POINT TEMPERATURE:

To determine **DEW POINT TEMPERATURE** (^{0}C), get your readings from the wet and dry bulbs of a sling psychrometers.

a. Find the **DRY BULB** temperature on the graph.
b. Subtract the dry bulb and wet bulb temperatures and find the **DIFFERENCE** between them on the graph.
c. Example:

Dry Bulb Temperature = 14^{0}C
Wet Bulb Temperature = 10^{0}C
Difference between Wet and Dry Bulb Temperatures= **4^{0}C**
DEW POINT TEMPERATURE = **6^{0}C**

Dewpoint (°C)

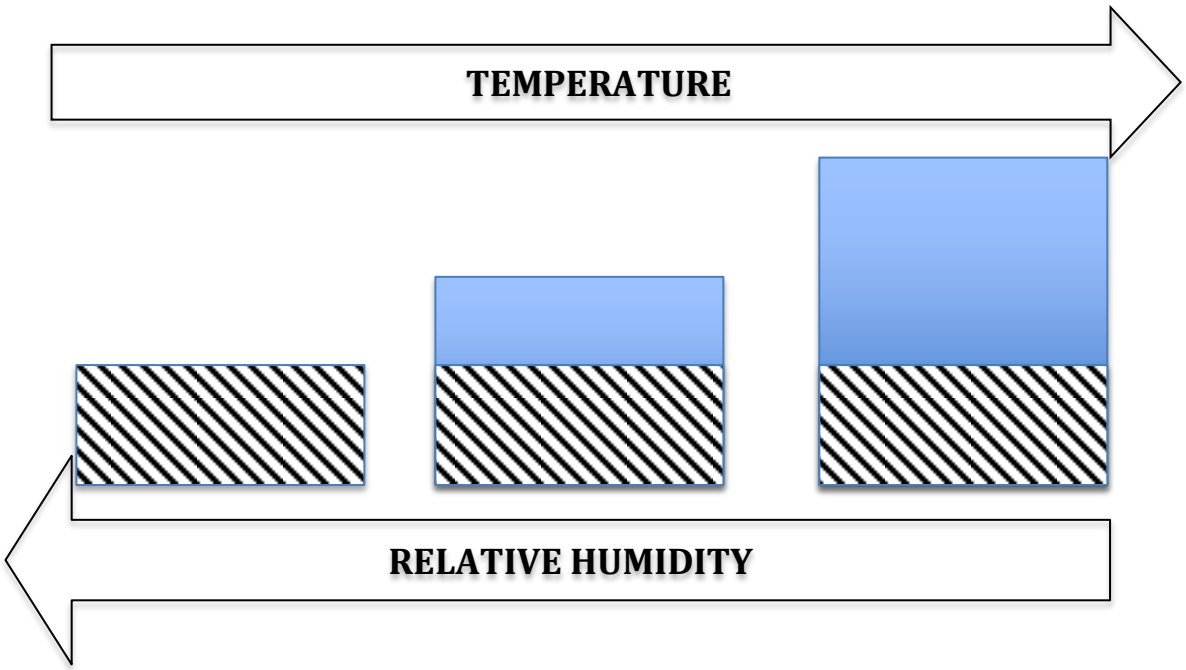
Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	−20	−33														
−18	−18	−28														
−16	−16	−24														
−14	−14	−21	−36													
−12	−12	−18	−28													
−10	−10	−14	−22													
−8	−8	−12	−18	−29												
−6	−6	−10	−14	−22												
−4	−4	−7	−12	−17	−29											
−2	−2	−5	−8	−13	−20											
0	0	−3	−6	−9	−15	−24										
2	2	−1	−3	−6	−11	−17										
4	4	1	−1	−4	−7	−11	−19									
6	6	4	1	−1	−4	−7	−13	−21								
8	8	6	3	1	−2	−5	−9	−14								
10	10	8	6	4	1	−2	−5	−9	−14	−28						
12	12	10	8	6	4	1	−2	−5	−9	−16						
14	14	12	11	9	6	4	1	−2	−5	−10	−17					
16	16	14	13	11	9	7	4	1	−1	−6	−10	−17				
18	18	16	15	13	11	9	7	4	2	−2	−5	−10	−19			
20	20	19	17	15	14	12	10	7	4	2	−2	−5	−10	−19		
22	22	21	19	17	16	14	12	10	8	5	3	−1	−5	−10	−19	
24	24	23	21	20	18	16	14	12	10	8	6	2	−1	−5	−10	−18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	−4	−9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	−3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

e. Use the ESRT Dew Point Temperature Chart (ESRT Page 12) to determine the dew point temperature for the following data

DRY BULB TEMP	22⁰C	22⁰C	20⁰C	15⁰C	9⁰C	8⁰C	17⁰C
WET BULB TEMP	20⁰C	13⁰C	14⁰C	12⁰C	3⁰C	6⁰C	17⁰C
DEW POINT TEMP (⁰C)							

f. **RELATIVE HUMIDITY – THE RATIO (COMPARISON) BETWEEN THE ACTUAL AMOUNT OF WATER VAPOR IN THE AIR TO THE MAXIMUM AMOUNT OF WATER VAPOR THE AIR CAN HOLD AT A CERTAIN TEMPERATURE.**

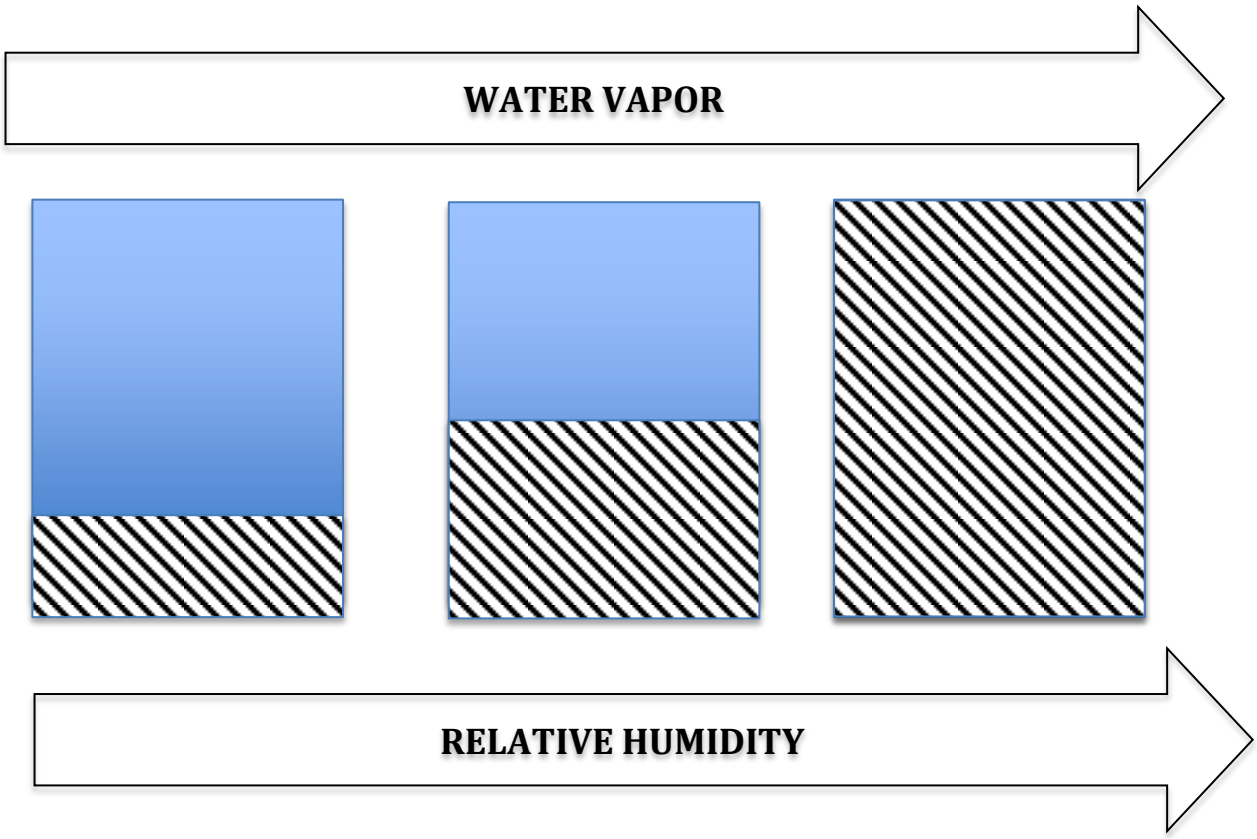
i. Changing Air Temperature



1. **IF TEMPERATURE INCREASES, AND MOISTURE IN THE AIR REMAINS THE SAME, RELATIVE HUMIDITY WILL DECREASE**.

2. Time of Day:
   a. Highest Relative Humidity = **COOLEST TIME OF DAY – 5:00 AM**
   b. Lowest Relative Humidity = **WARMEST TIME OF DAY – 3:00 PM**

ii. Changing Absolute Humidity (actual water vapor content).



1. **IF MOISTURE CONTENT OF THE AIR INCREASES, AND TEMPERATURE REMAINS THE SAME, RELATIVE HUMIDITY WILL INCREASE.**

ESRT PAGE 12: DETERMINING RELATIVE HUMIDITY:

To determine **relative humidity** (%), get your readings from the wet and dry bulbs of a sling psychrometers.

a. Find the **DRY BULB** temperature on the graph.
b. Subtract the dry bulb and wet bulb temperatures and find the **DIFFERENCE** between them on the graph.

c. Example:

Dry Bulb Temperature = 12^{0}C
Wet Bulb Temperature = 10^{0}C
Difference between Wet and Dry Bulb Temperatures= **2^{0}C**
DEW POINT TEMPERATURE = **78%**

Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	100	28														
−18	100	40														
−16	100	48														
−14	100	55	11													
−12	100	61	23													
−10	100	66	33													
−8	100	71	41	13												
−6	100	73	48	20												
−4	100	77	54	32	11											
−2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

a. Use the ESRT RELATIVE HUMIDITY Chart (ESRT Page 12) to determine the relative humidity for the following data

DRY BULB TEMP	20^{0}C	8^{0}C	22^{0}C	22^{0}C	15^{0}C	15^{0}C	3^{0}C
WET BULB TEMP	14^{0}C	6^{0}C	13^{0}C	20^{0}C	12^{0}C	15^{0}C	-1^{0}C
RELATIVE HUMIDITY (%)	**51%**	**74%**	**33%**	**83%**	**70%**	**100%**	**39%**

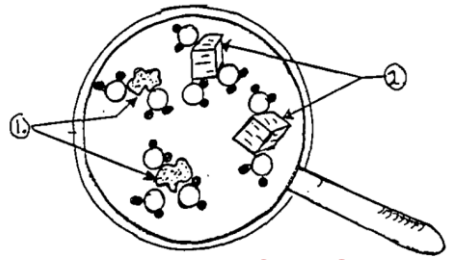
IX. CLOUDS

a. Clouds are tiny droplets of liquid water or tiny ice crystals suspended in air.

b. Combination of conditions needed to foam clouds:
   i. **MOISTURE IN THE AIR**
   ii. **COOLING TEMPERATURES**
   iii. **DUST PARTICLES OR "CONDENSATION NUCLEI"**

c. Condensation Nuclei = **AEROSOLS (TINY PARTICLES OF SALT / DUST) IN THE ATMOSPHERE WHICH PROVIDE A SURFACE FOR WATER MOLECULES TO CONDENSE ONTO.**
   i.

DUST PARTICLES

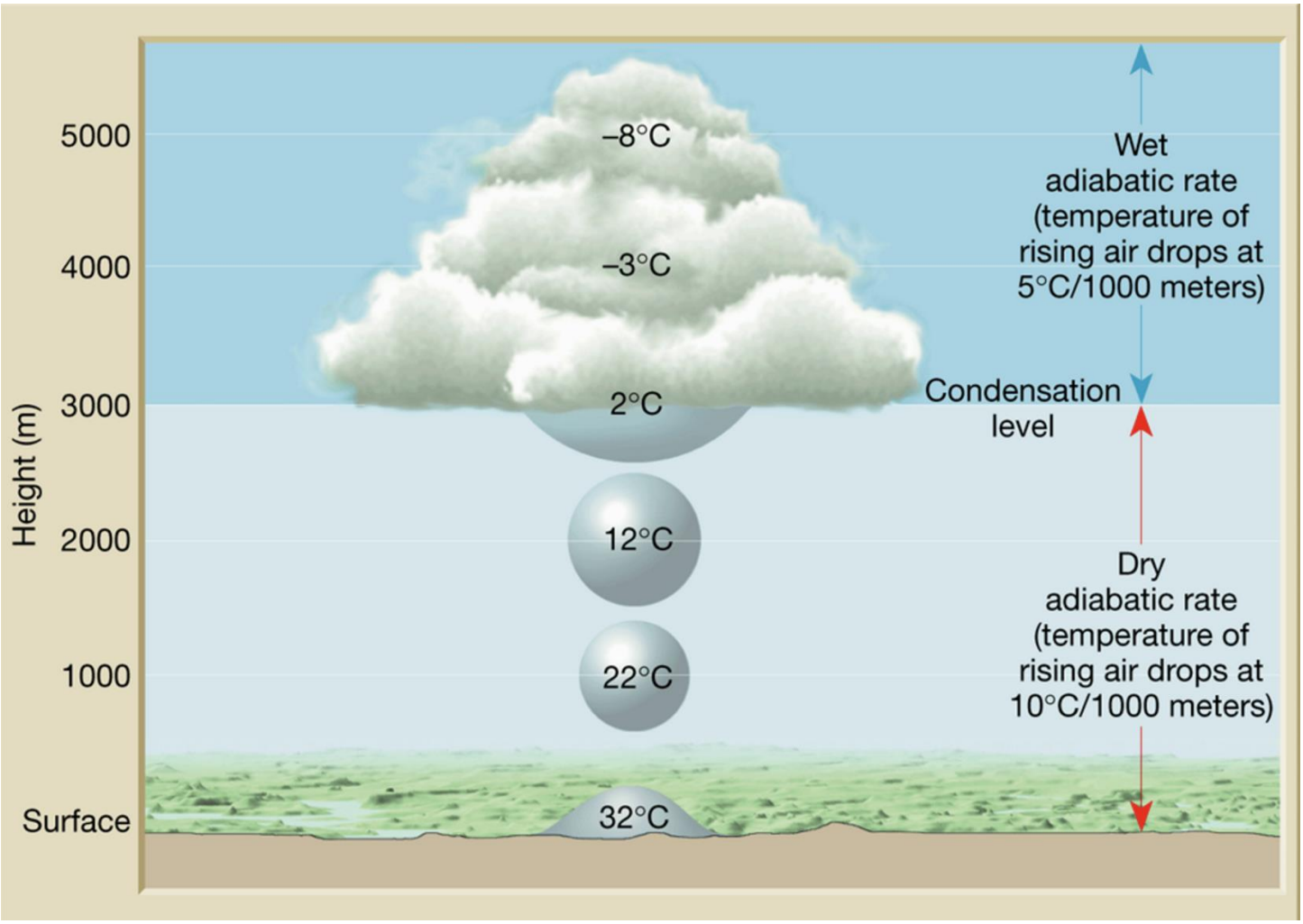


SALT PARTICLES

= **WATER MOLECULE**

d. Condensation in cloud formation incorporates some of the aerosols as **CONDENSATION NUCLEI**, therefore these aerosols are removed from the atmosphere during precipitation. Precipitation, therefore, **CLEANS THE AIR**

e. Cooling in the atmosphere – Adiabatic Cooling
   i. As air **RISES**, the atmospheric pressure surrounding the parcel of air decreases. Therefore, the parcel of air **EXPANDS** in volume as it rises.
   ii. As the air rises, it becomes **COOLER**.
   iii. When the temperature of this parcel of air cools to the **DEW POINT TEMPERATURE**, the water vapor in the air **CONDENSES** and a **CLOUD** appears in the sky.

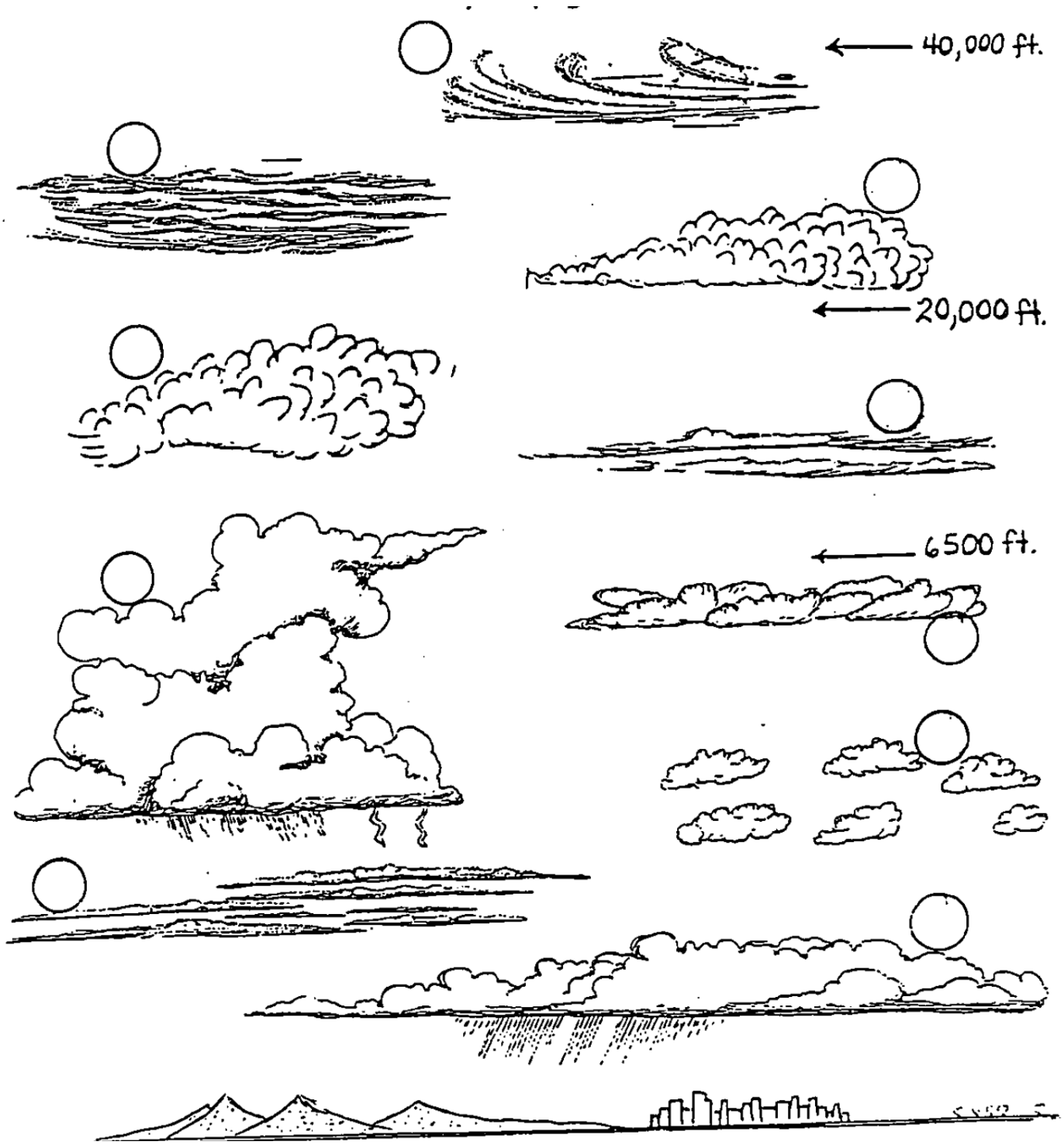


f. Cloud Types

i. Key meanings:

1. **CIRRUS** – Wisps or curls
2. **STRATUS** – Spread or layered
3. **CUMULUS** – Heaps or piles
4. **ALTO** – Prefix meaning "high"
5. **NIMBUS** – Rain-bearing or snow bearing

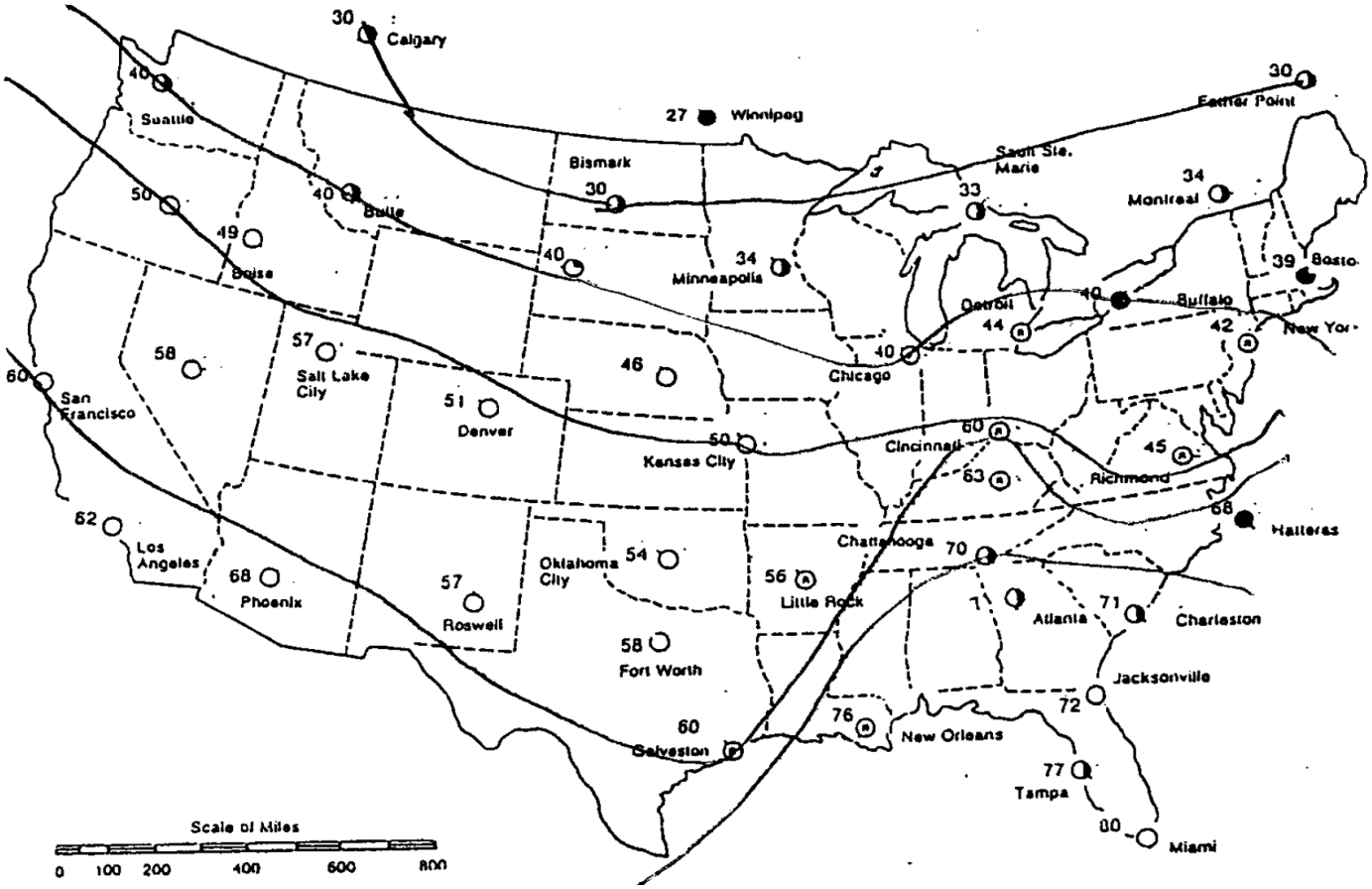
ii.



X. MAPPING A TEMPERATURE FIELD:

a. **ISOTHERMS** are lines that connect points of equal temperature. Showing temperature distribution in this way makes patterns easier to see.

DRAW ISOTHERMS AT 10^0 INTERVALS (30^0, 40^0, 50^0, 60^0, 70^0, AND 80^0)



b. The greatest temperature gradient is between **RICHMOND** and **HATTERAS** which is indicated because the isotherms are **CLOSEST TOGETHER**.

c. Temperature gradient calculation from Cincinnati to Chicago:

$$G - \frac{60^0F - 40^0F}{250\ mi.} = \frac{20^0F}{250\ mi.} = .08\ ^0F/mi$$

XI. Mapping an Air Pressure Field

a. ISOBARS are lines that connect points of equal air pressure. Showing air pressure distribution in this way makes patterns eaier to see.
   On United States Weather Bureau maps, the interval between isobars is 4mb.

b. On weather maps, the barometric pressure in millibars is too large a number so it is represented by a three-digit number to the upper right of a circle; this circle represents a city on the map. **This number is an abbreviation of the actual barometric pressure in millibars**.

053

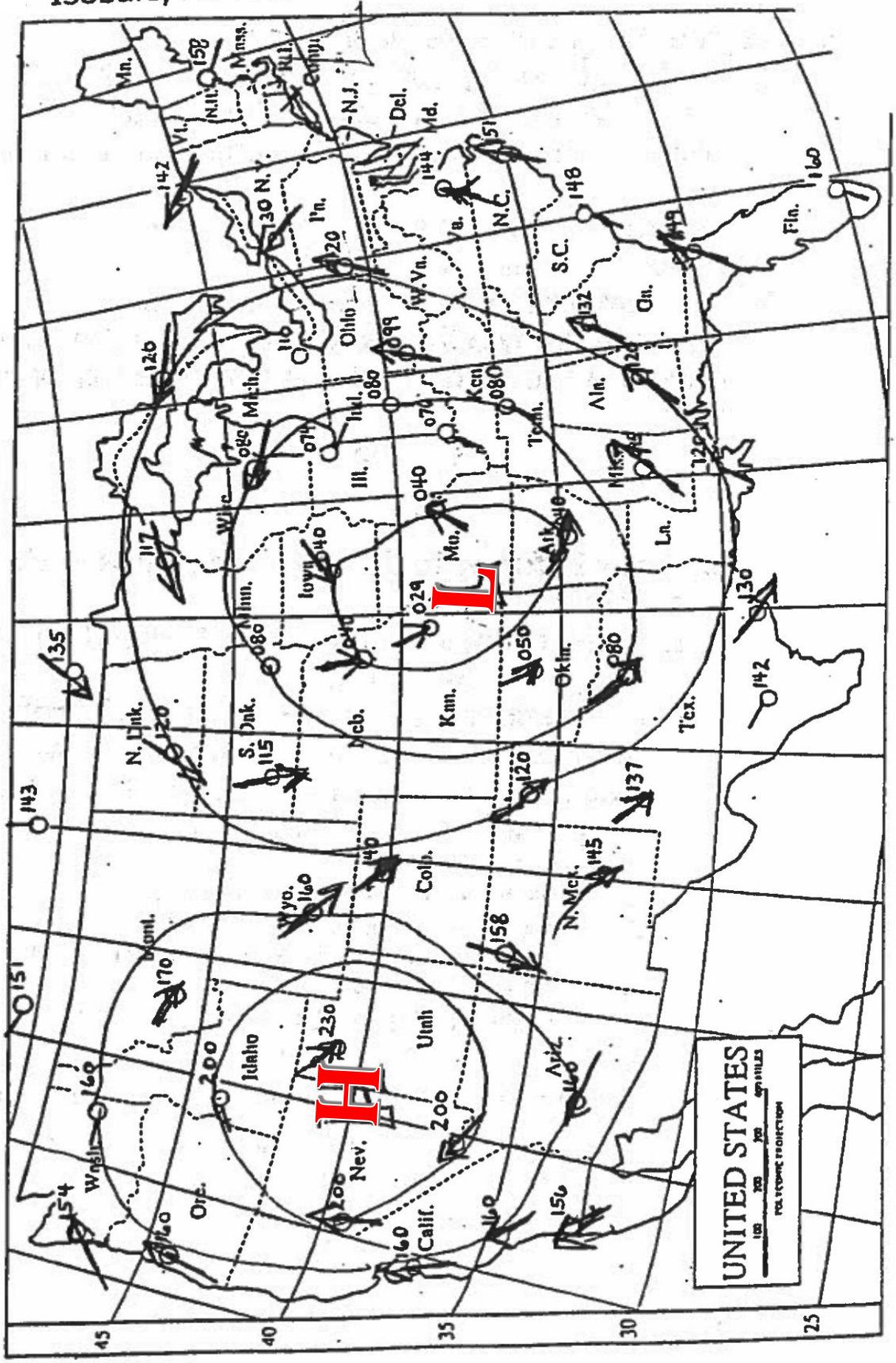
c. Understanding the abbreviation for barometric pressure:
   1. A decimal point was removed between the last two digits on the right.
   2. The number 9 or 10 was removed in front of this number.
   3. To expand the abbreviation to millibars:
      a. If the number is **GREATER** than **500**, put a **9** in front of it.
      b. If the number is **LESS** than **500**, put a **10** in front.
      c. Put a decimal point **between the last two numbers**.
      d. EXAMPLE:
         i. 053 (< 500) = **1005.3 mb**
         ii. 624 (>500) = **962.4 mb**

d. On the map on the next page, draw isobars for 1004, 1008, 1012, 1016, and 1020 millibars.

e. Identify the center of the **high-pressure region** by placing an **H** on the map

f. Identify the center of the **Low-pressure region** by placing an **L** on the map

Isobars, Air Pressure and Winds



KEY:

Millibars	Map Abbreviation
1024.0	240
1020.0	200
1016.0	160

Millibars	Map Abbreviation
1012.0	120
1008.0	080
1004.0	040

XII. AIR MASSES AND FRONTS

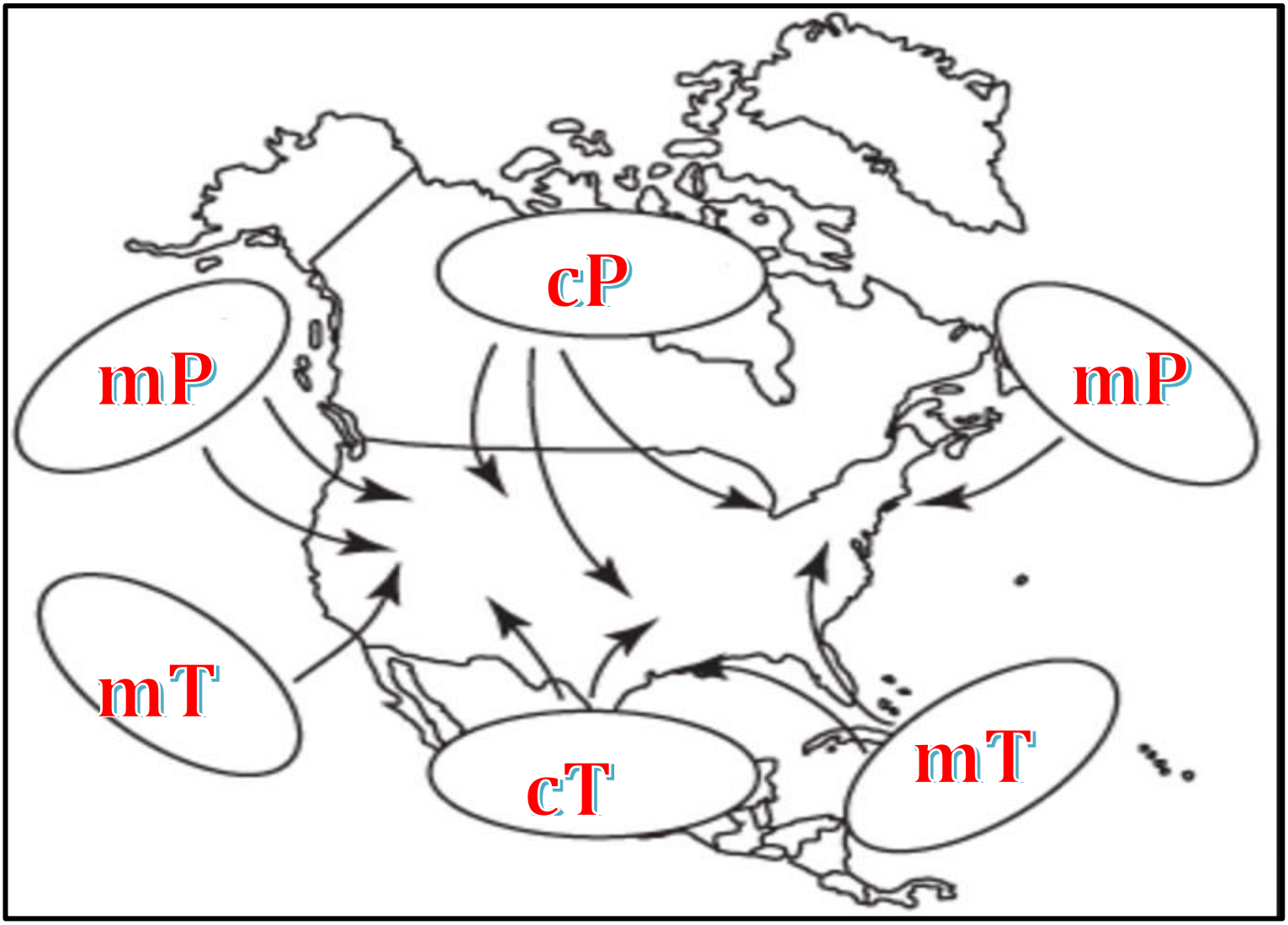
a. **AIR MASS** = a large body of air in the troposphere with similar characteristics of: **TEMPERATURE**, **MOISTURE**, **PRESSURE**.
   i. **Source Region**: **A GEOGRAPHIC REGION WHERE AN AIR MASS FORMS (DEVELOPS)**.
   This happens as air stagnates (sits) over a particular part of earth's surface for a long enough period of time to acquire the temperature and/or moisture characteristics of the surface in that region.

b. Types of Air Masses:
   i. **TROPICAL**: originates in tropics (low latitudes). Characterized by **high temperatures**.
   ii. **POLAR**: Originates in polar regions (high latitudes). Characterized by **LOW TEMPERATURES**.
   iii. **ARCTIC**: Originates in ice-covered arctic regions (in winter only). **Very cold and dry**.
   iv. **CONTINENTAL**: originates over land masses. **DRY**
   v. **MARITIME**: originates over water. **WET**

c. Air Masses Are A Combination Of Temperature And Moisture Conditions.

SYMBOL	NAME OF AIR MASS	CHARACTERISTICS
cP	**CONTINENTAL POLAR**	**COLD & DRY**
mT	**MARITIME TROPICAL**	**WARM & MOIST**
cT	**CONTINENTAL TROPICAL**	**HOT AND DRY**
mP	**MARITIME POLAR**	**COOL AND MOIST**

Illustrated below are the source regions for air masses that affect the weather of North America. The arrows indicate the tracks / paths that these air masses usually follow.



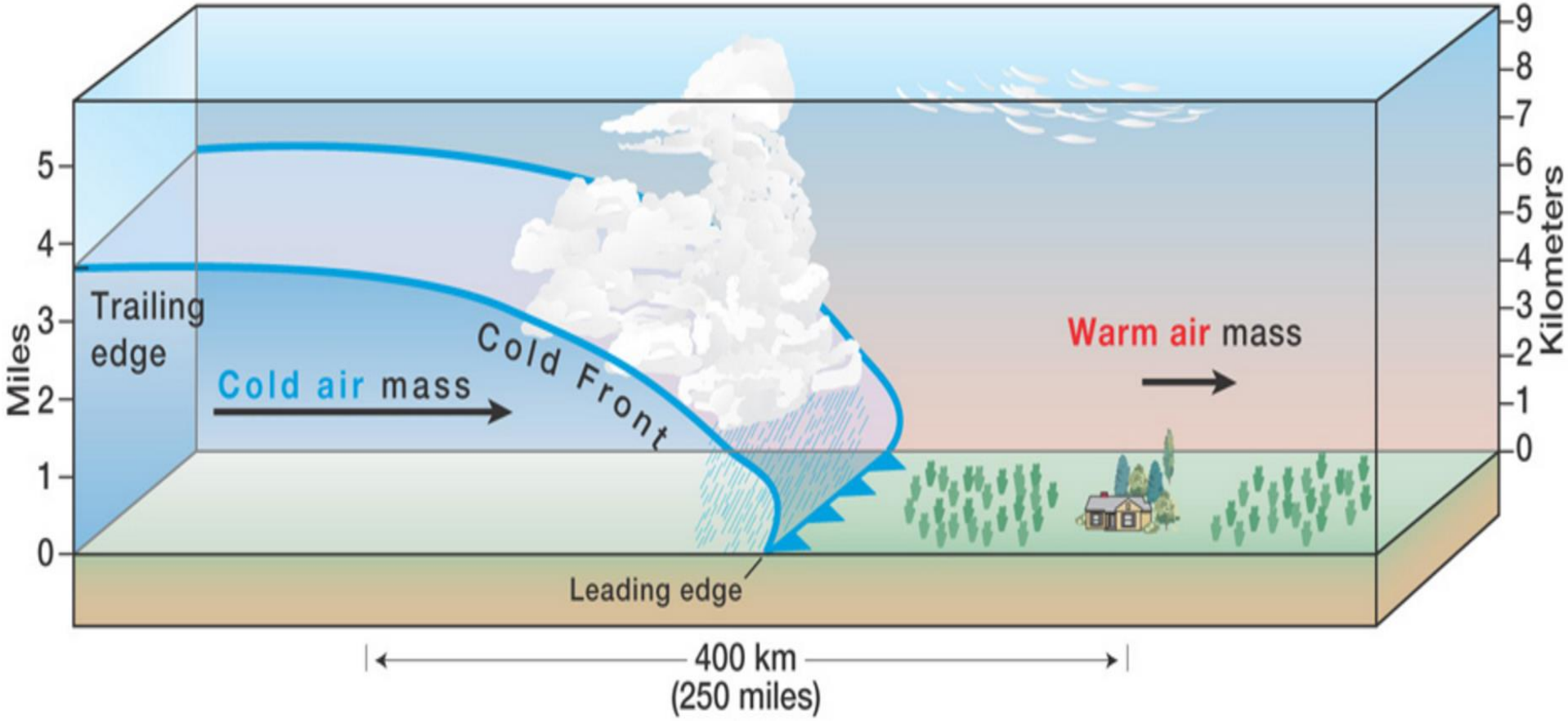
b. FRONT – a boundary between air masses

i. Types of fronts:

FRONT	MAP SYMBOL
COLD FRONT	
WARM FRONT	
STATIONARY FRONT	
1. : **OCCLUDED FRONT**	

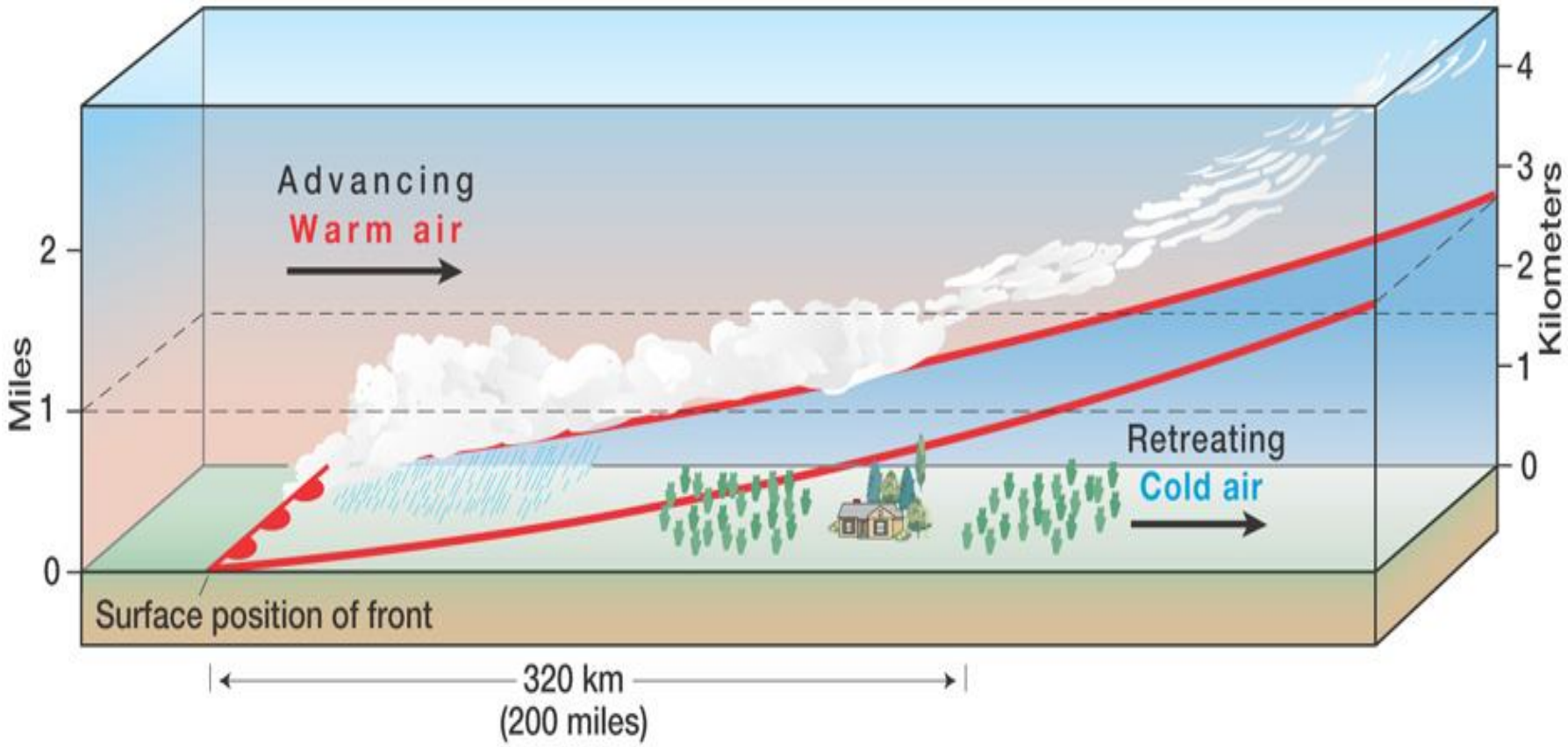
COLD FRONT

- THE LEADING DGE OF COLD AIR THAT IS ADVNCING AND DISPLACING WARMER AIR.
- **A NARROW BAND OF HEAVY RAIN USUALLY PRECEEDS A COLD FRONT.**



WARM FRONT

- THE LEADING DGE OF WARM AIR THAT IS ADVNCING AND DISPLACING COLDER AIR.
- **A WIDE BAND OF LIGHT, STEADY SHOWERS USUALLY PRECEEDS A WARM FRONT.**



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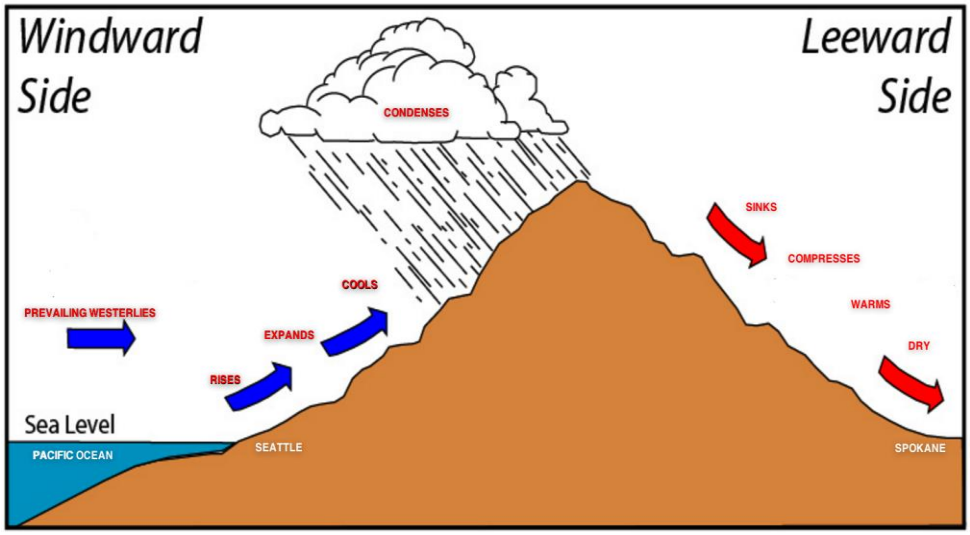
ii. **STATIONARY FRONT**- Surface winds blow in opposite directions on either side of the front causing no movement of either air mass. Weather is clear to partly cloudy.

iii. **OCCLUDED FRONT** – Occurs when a cold front catches up to and overtakes a warm front. The warm air is lifted off the ground. Widespread cloudiness and precipitation are associates with an occluded front.

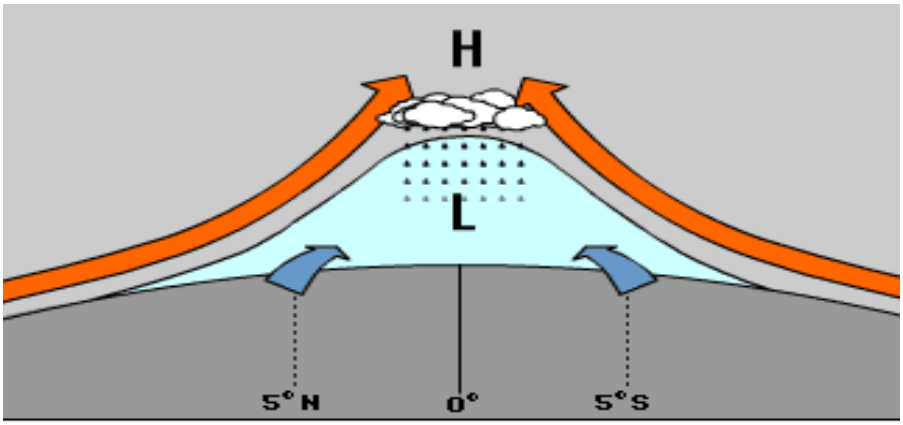
XIII. Areas of rainfall

a. Regions on earth where air rises and cools to the dew point temperature and condenses. Results in clouds and precipitation.

i. WINDWARD side of a mountain.

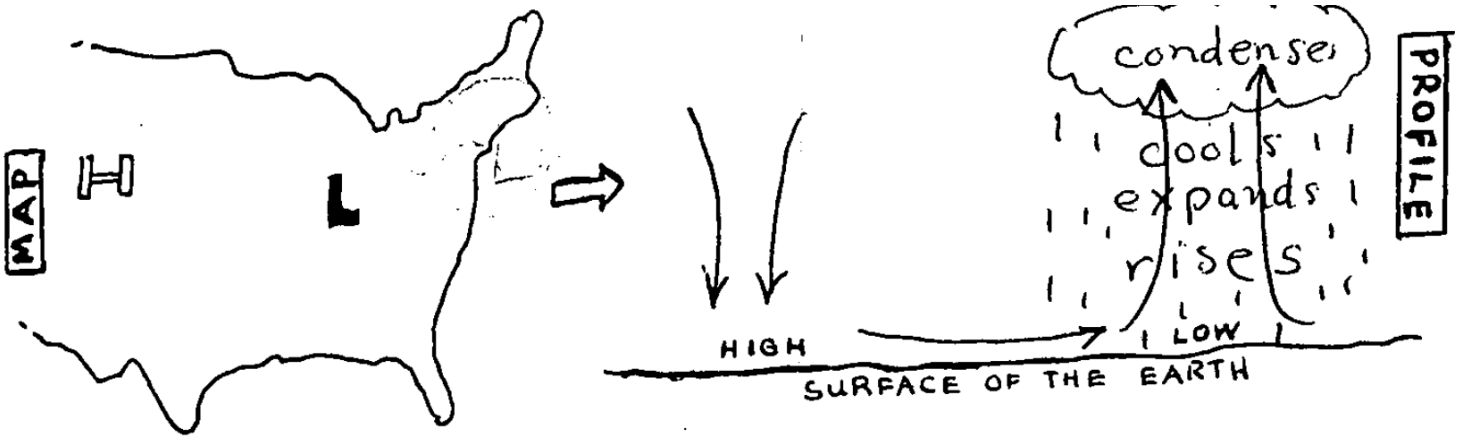


ii. DOLDRUMS – the equatorial region where warm, humid air rises because of convection. This produces thunderstorms almost daily.

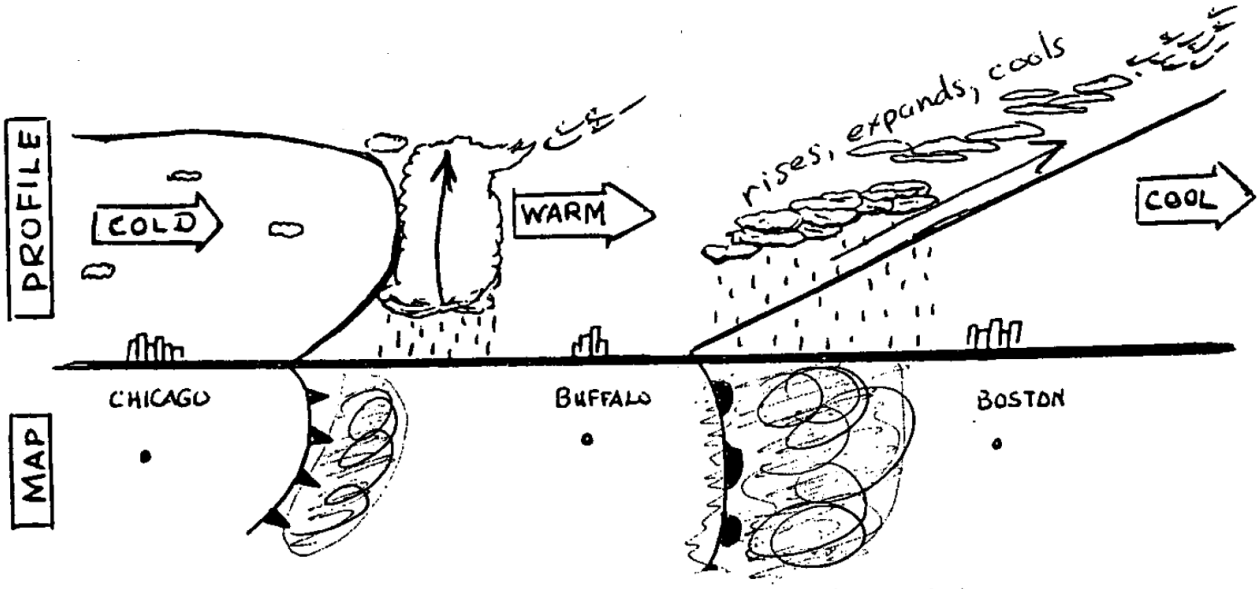


As the high pressure rises near the equator, low pressure is pulled into the region often causing windless, rainy weather patterns.

iii. **LOW** Pressure Systems (including Hurricanes)



iv. Along a **FRONT**:

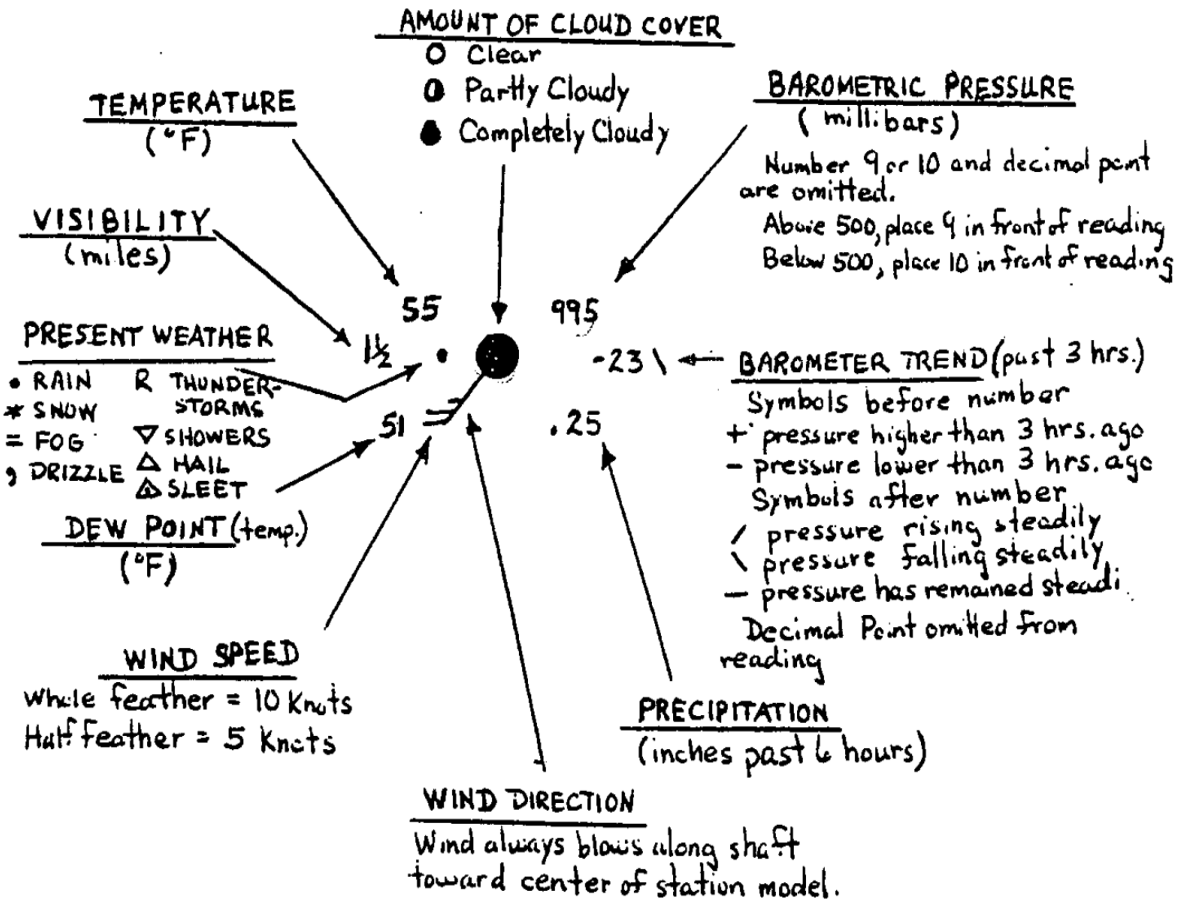


b. **Areas of little precipitation** – regions on Earth where air is **SINKING, COMPRESSING, WARMING** and becomes less humid, or drier.
   i. **LEEWARD SIDE OF A MOUNTAIN**
   ii. **HORSE LATITUDES**
   iii. **HIGH PRESSURE SYSTEMS**

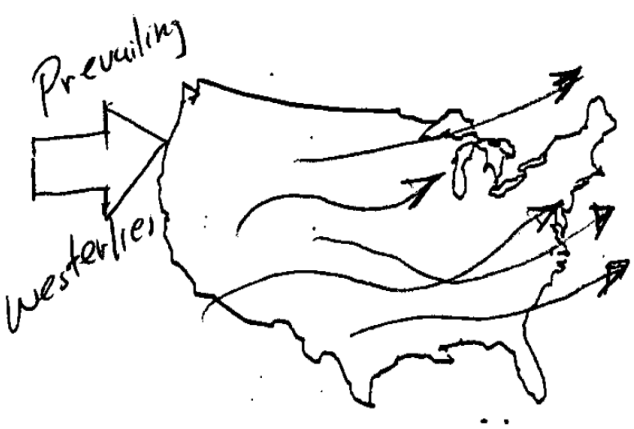
c. Rainfall comparisons:
   i. Death Valley, California – average rainfall **1** inch per year.
   ii. Cherrapunja, India - average rainfall **457** inch per year.
   iii. Amazon Valley, Brazil – It may rain **EVERY DAY**.
   iv. Deserts of Peru (South America) – It does not rain for **years** at a time.

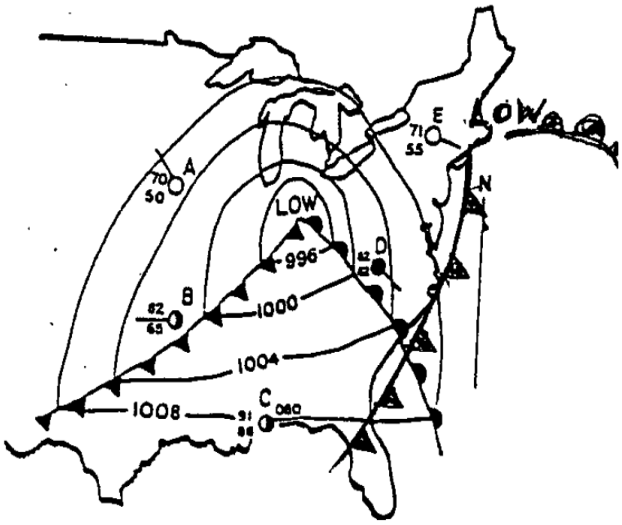
XIV. WEATHER MAPS:

a. STATION MODELS_ On weather maps, the weather conditions for each weather station are shown by symbols arranged in and around a small circle. These symbols and the circle make up a station model which gives the latest readings for the most important weather variables.



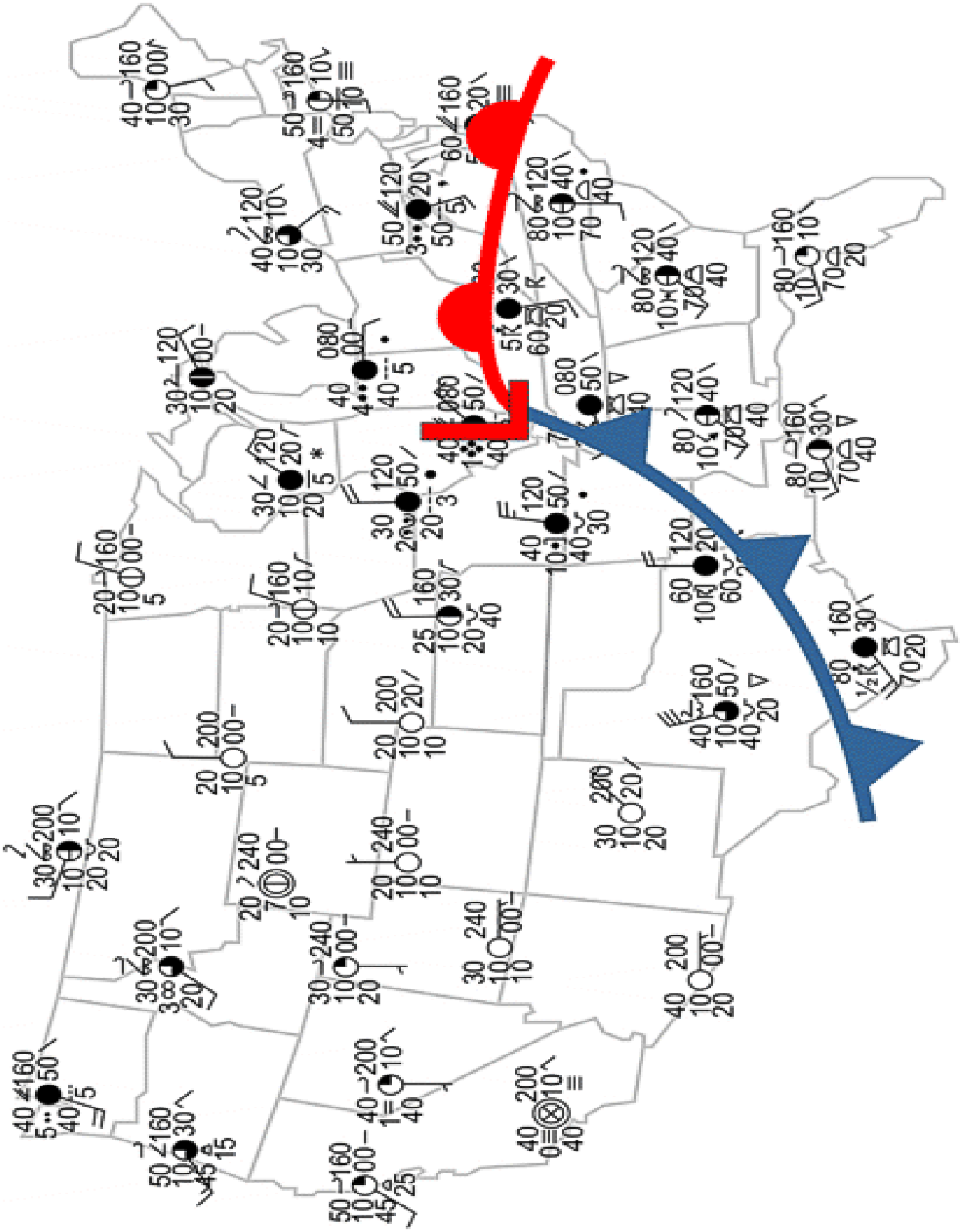
B. Storm Tracks



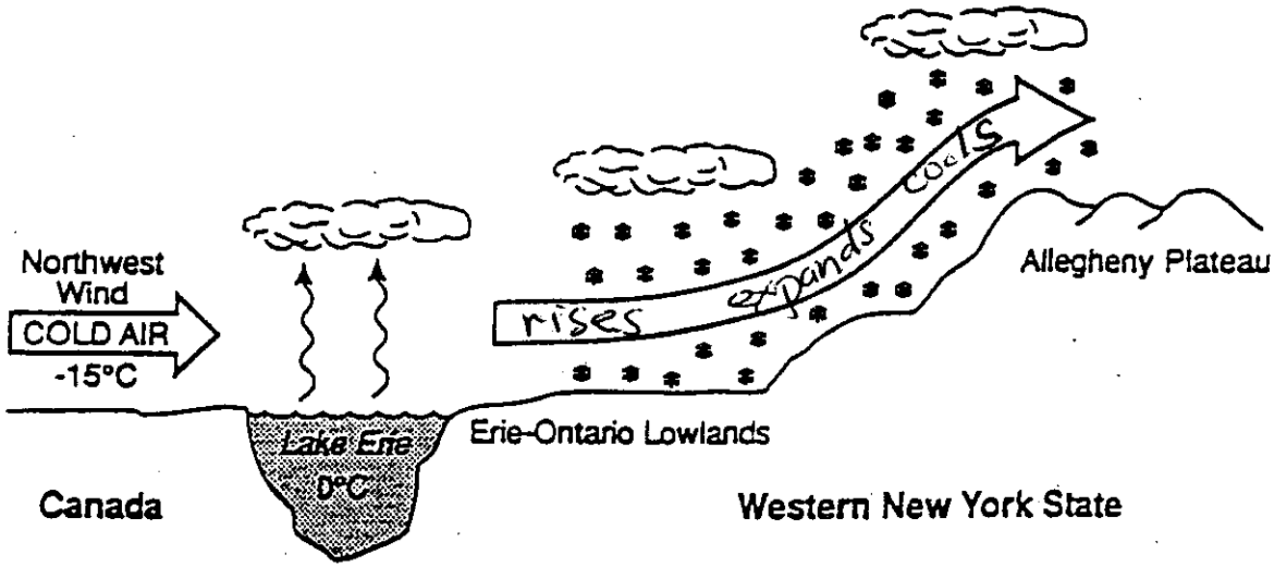


c. Weather Map

i. Synoptic (a map that describes current weather and is used for prediction).



e. Lake Effect Snow:



UNIT 7 EXAM TOPICS

ENERGY
- Color And Texture
- Specific Heat
- Conduction, Convection & Radiation
- Phase Changes

TEMPERATURE
- Temperature Vs Density

PRESSURE
- Circulation
- Highs And Lows
- Movement Of Systems

WIND
- Land And Sea Breeze
- High To Low
- Pressure Gradient
- Planetary Winds

MOISTURE
- Rate Of Evaporation
- Temp. Vs Dew Point Temp
- Transpiration
- Relative Humidity

CLOUDS
- Air Rises
- Condensation Nuclei

AIR MASSES
- Characteristics
- Source Regions

FRONTS
- Where They Belong
- Characteristics
- What They Do

STATION MODELS
- Draw
- Read

OROGRAPHIC EFFECT
- Air Over A Mountain

SEVERE WEATHER
- Hurricane
- Tornado

ATMOSPHERIC TRANSPARENCY

VOCABULARY

UNIT 7 VOCABULARY

Air Mass
Air Pressure
Air Pressure Gradient
Anemometer
Atmospheric Transparency
Cold Front
Condensation
Conduction
Convection
Cyclone
Dew Point
Electromagnetic Energy
Electromagnetic Spectrum
Energy
Front
Heat Energy
Humidity
Isobar
Jet Stream
Mechanical Energy
Monsoon
Occluded Front
Planetary Wind Belt
Precipitation
Psychrometer
Radar
Radiation
Relative Humidity
Solidification
Specific Heat
Station Model
Stationary Front
Temperature
Texture
Troposphere
Vaporization
Visibility
Warm Front
Water Vapor
Wavelength