Private Pilot (ASEL) Ground School Course

Lesson 17 | Weather Theory

Lesson Overview

Lesson Objectives:

- Develop knowledge of aviation weather theory.
- Develop an understanding of how to handle weather hazards and make appropriate decisions.

Lesson Completion Standards:

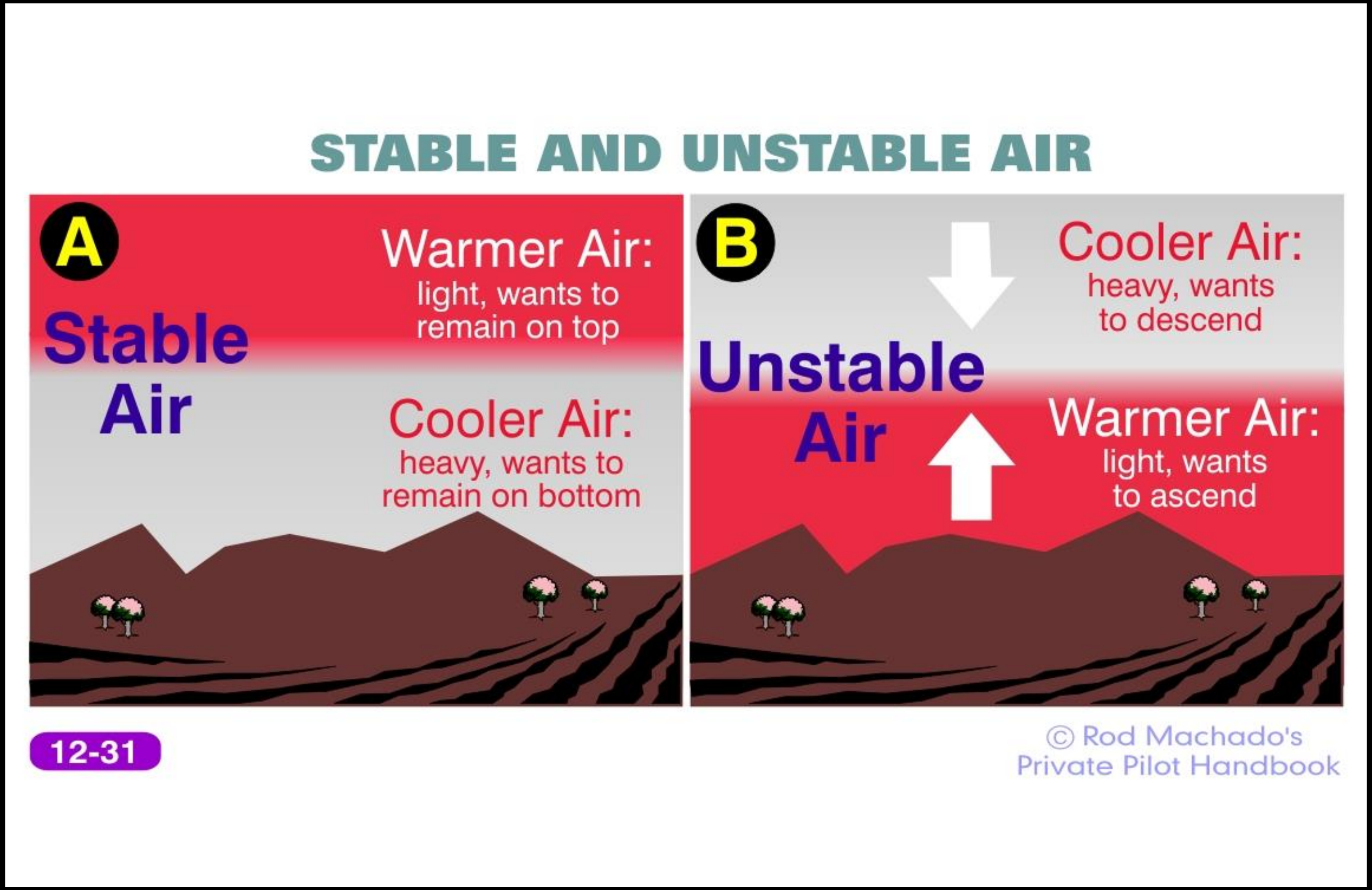
- Student demonstrates satisfactory knowledge of weather theory by answering questions and actively participating in classroom discussions.

Atmospheric Stability

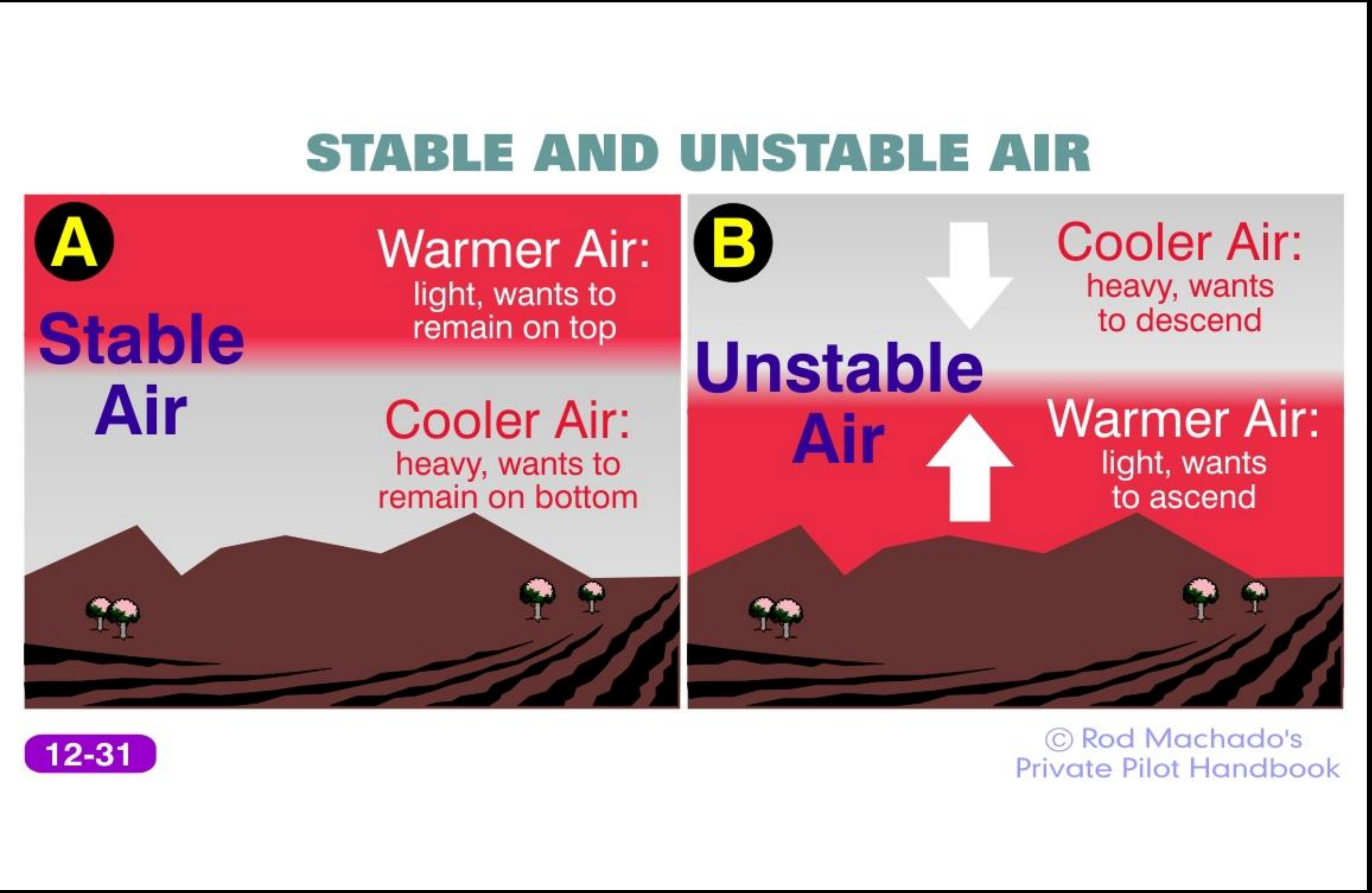
- The atmosphere is stable when it resists the upward movement of air
- Stable air, if given an upward shove, sinks back to its original level
- It is unstable when it permits or amplifies this upward movement
- Unstable air, if shoved upward, continues to climb on its own

Atmospheric Stability

- A warmer layer of air above a cooler layer of air is a stable condition
- This is a temperature inversion and it forms in stable air
- These two layers don't want to change places



Atmospheric Instability



- In unstable air a warmer layer of air is found below a cooler layer of air
- These two layers want to change places
- This is an unstable condition and vertical motion (convection) occurs between these two layers

Environmental Lapse Rate

- *Average* Standard Lapse rate is 3.5F (2C) per thousand feet
- Environmental Lapse Rate is the *actual* rate at which atmospheric temperature changes with altitude
- Meteorologists also refer to the environmental lapse rate as the ***ambient*** lapse rate

Adiabatic Cooling and Heating

- Air cools from expansion as it's lifted, and heated by compression as it's forced downward
- Occurs without having to take heat away or add it to the parcel

Adiabatic Cooling

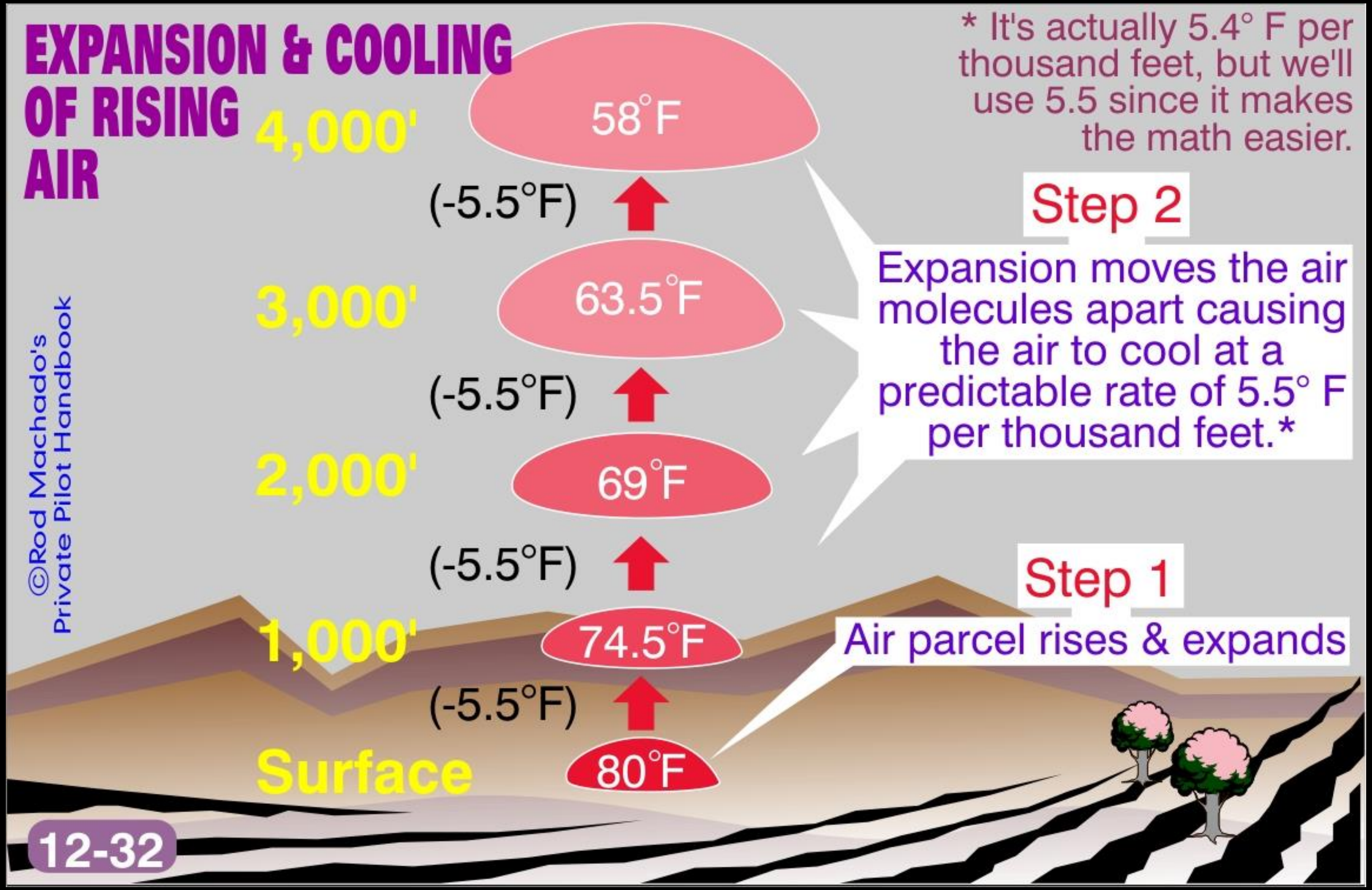
- Expanding a parcel of air by lifting moves its molecules farther apart, keeping them from bumping into one another
- Air molecules not being forced to bump into one another create less friction
- Energy has been used in expanding the parcel, which causes the molecules to slow down and air temperature decreases
- The parcel has cooled, yet no heat has been taken from it

Adiabatic Heating

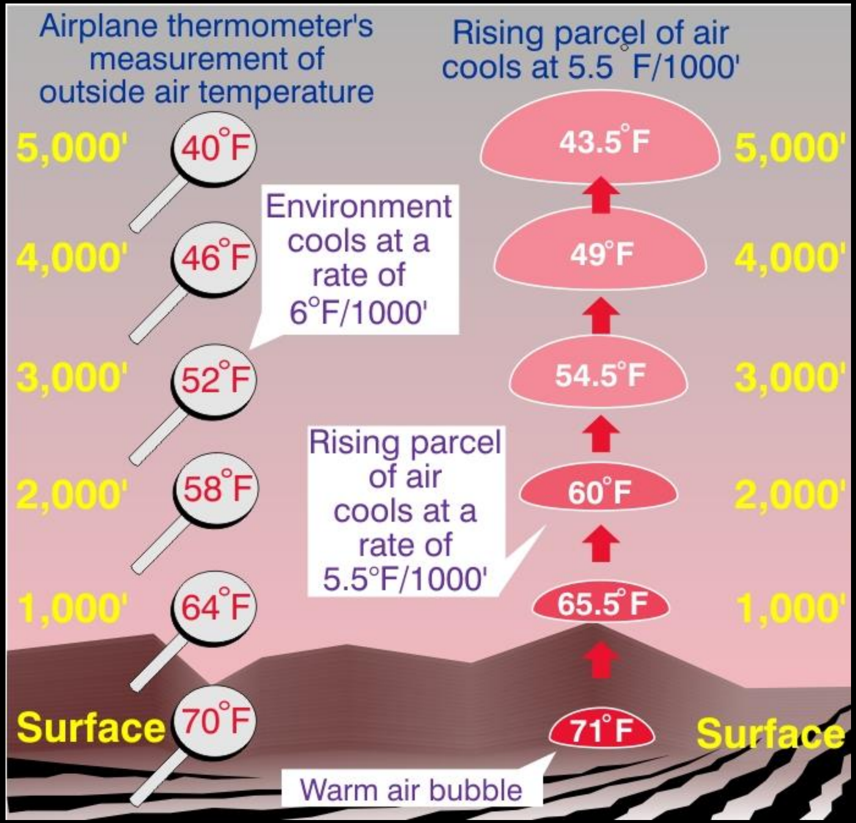
- Compressing a parcel of air by downward motion moves its molecules closer together and increases their speed
- This increases the air’s temperature
- No heat has been added to this parcel, yet it becomes warmed
- Adiabatic cooling or heating involves the lifting or falling of air and the resultant temperature change

Expansion and Cooling of Rising Air

- A warm parcel breaks away from the surface and rises into the cooler air aloft
- As a parcel of air expands, it also cools
- A rising parcel of air expands and cools at a constant rate of 5.4°F (3°C) for every thousand feet of climb, assuming that parcel remains unsaturated (doesn't form a cloud)



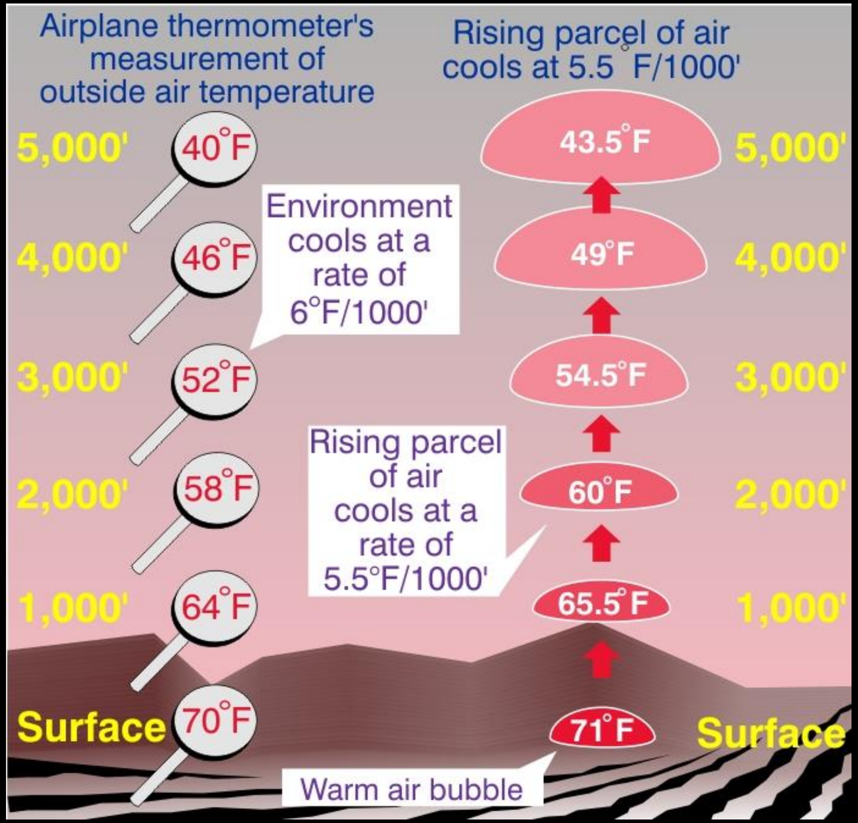
Environmental vs. Rising Parcel Lapse Rates In Unstable Air



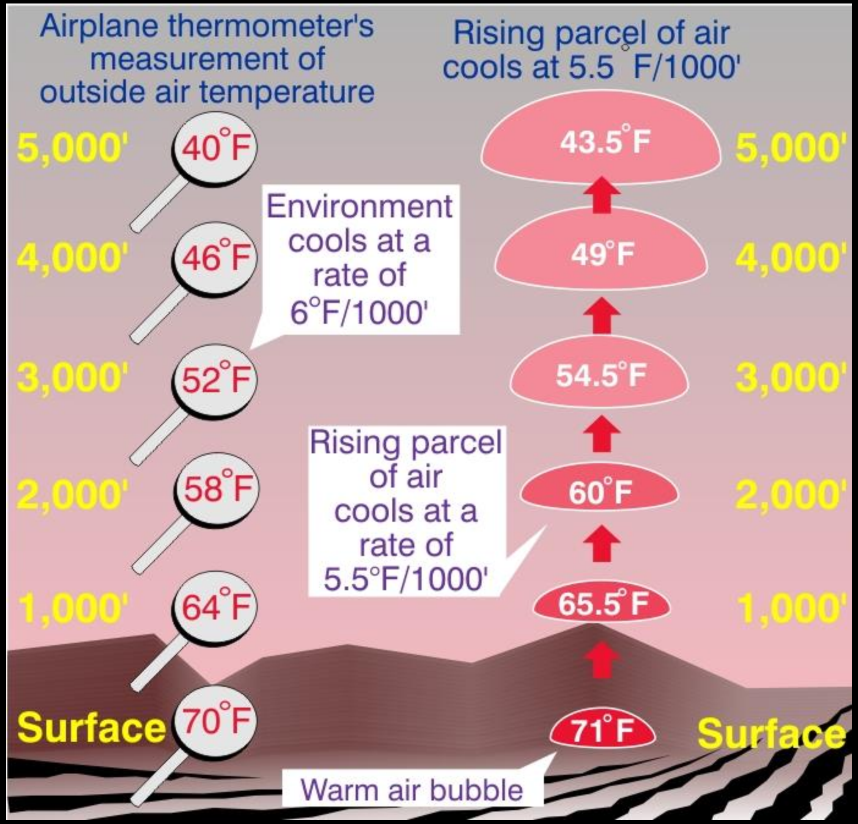
- The environmental lapse rate (measured by a thermometer in the airplane) changes 6°F per thousand feet
- A warm bubble of air at the surface starts to rise because it is 1° warmer than its environment

Environmental vs. Rising Parcel Lapse Rates In Unstable Air

- As the bubble ascends, it cools at the constant rate of 5.5°F per thousand feet
- As it rises it remains warmer than the environment



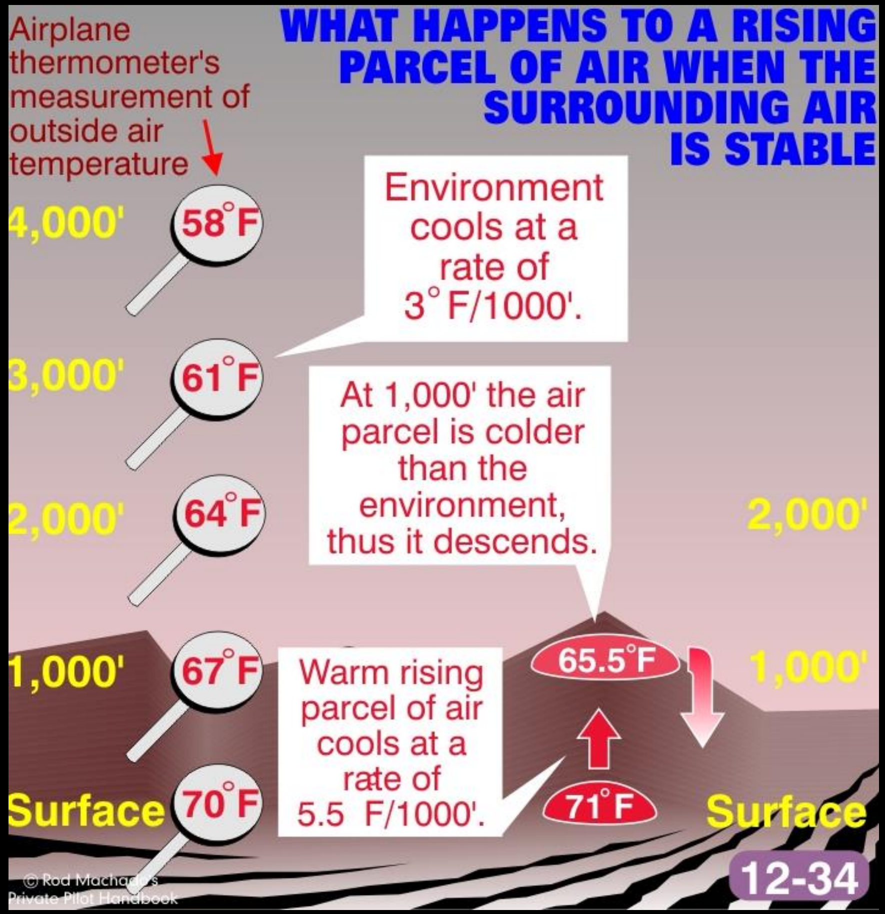
Environmental vs. Rising Parcel Lapse Rates In Unstable Air



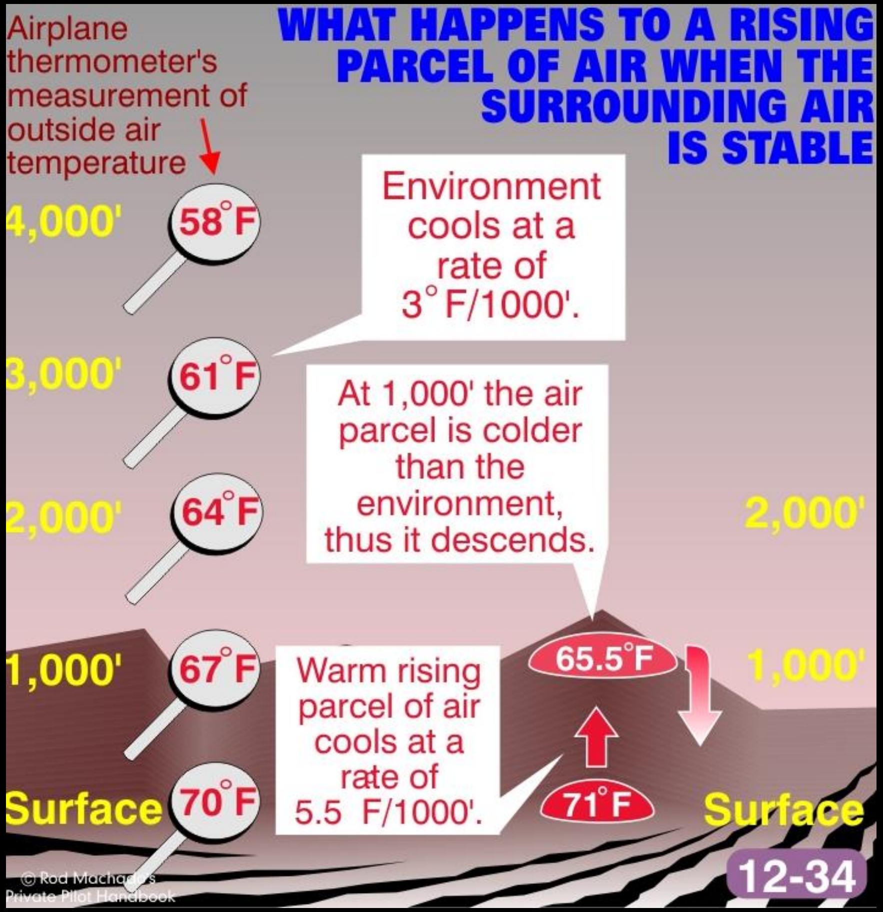
- As long as there is a temperature differential the parcel will keep moving up
- Because the temperature differential is now greater than it was at ground level, the air parcel will move even faster
- This atmosphere is unstable since it encourages upward motion of individual air parcels

Rising Parcel in Stable Air

- When the environment doesn't cool as quickly with an increase in altitude it is more stable
- In this example, the environment cools at only 3°F/1,000'



Rising Parcel in Stable Air



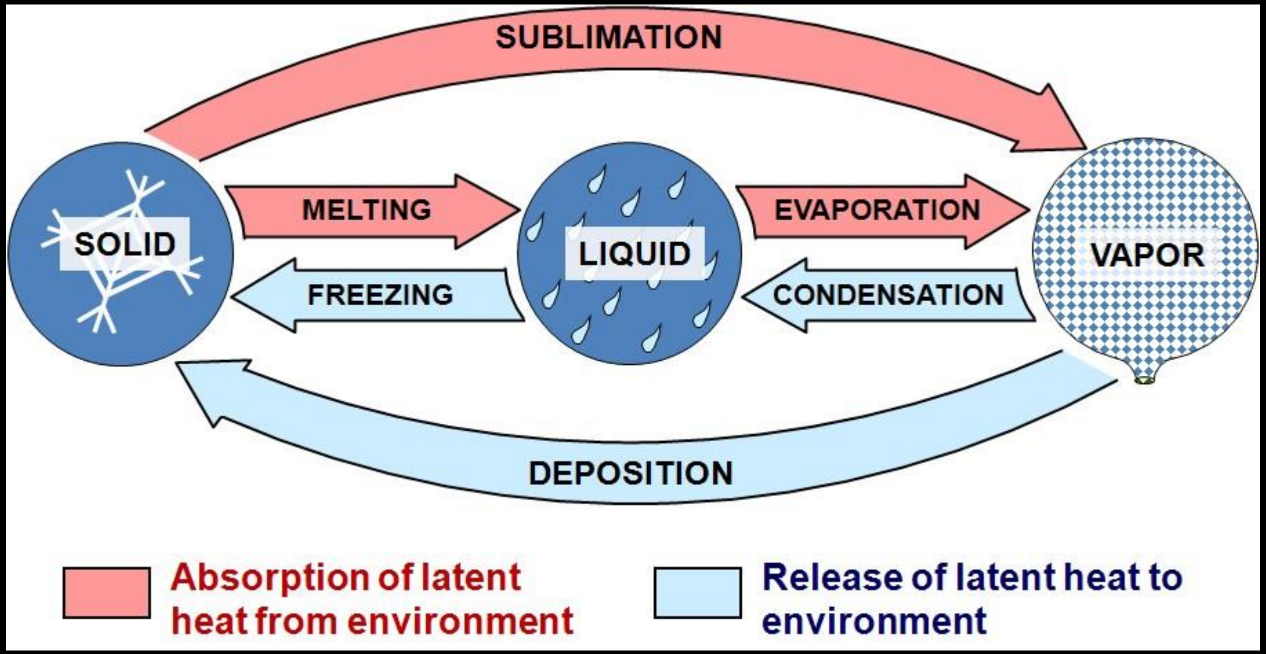
- A warm, rising parcel of air cooling at an expected rate of 5.5° F/1,000' can only ascend to 1,000' before it becomes cooler than its environment
- The environment (the surrounding atmosphere) is stable, and the cooler air bubble now descends

Atmospheric Stability

- The *environmental* lapse rate determines the stability of the atmosphere
- If the environment cools at exactly 5.4° F per thousand feet, then a parcel of air will have the same temperature as its surroundings if it's physically moved up or down
- The atmosphere would be neutrally stable
- A parcel will neither climb nor descend on its own

Latent Heat

- Latent heat is the quantity of heat energy either released or absorbed by a unit mass of a substance when it undergoes a phase transition (change of state)
- Latent heat transactions occur when water undergoes phase transition

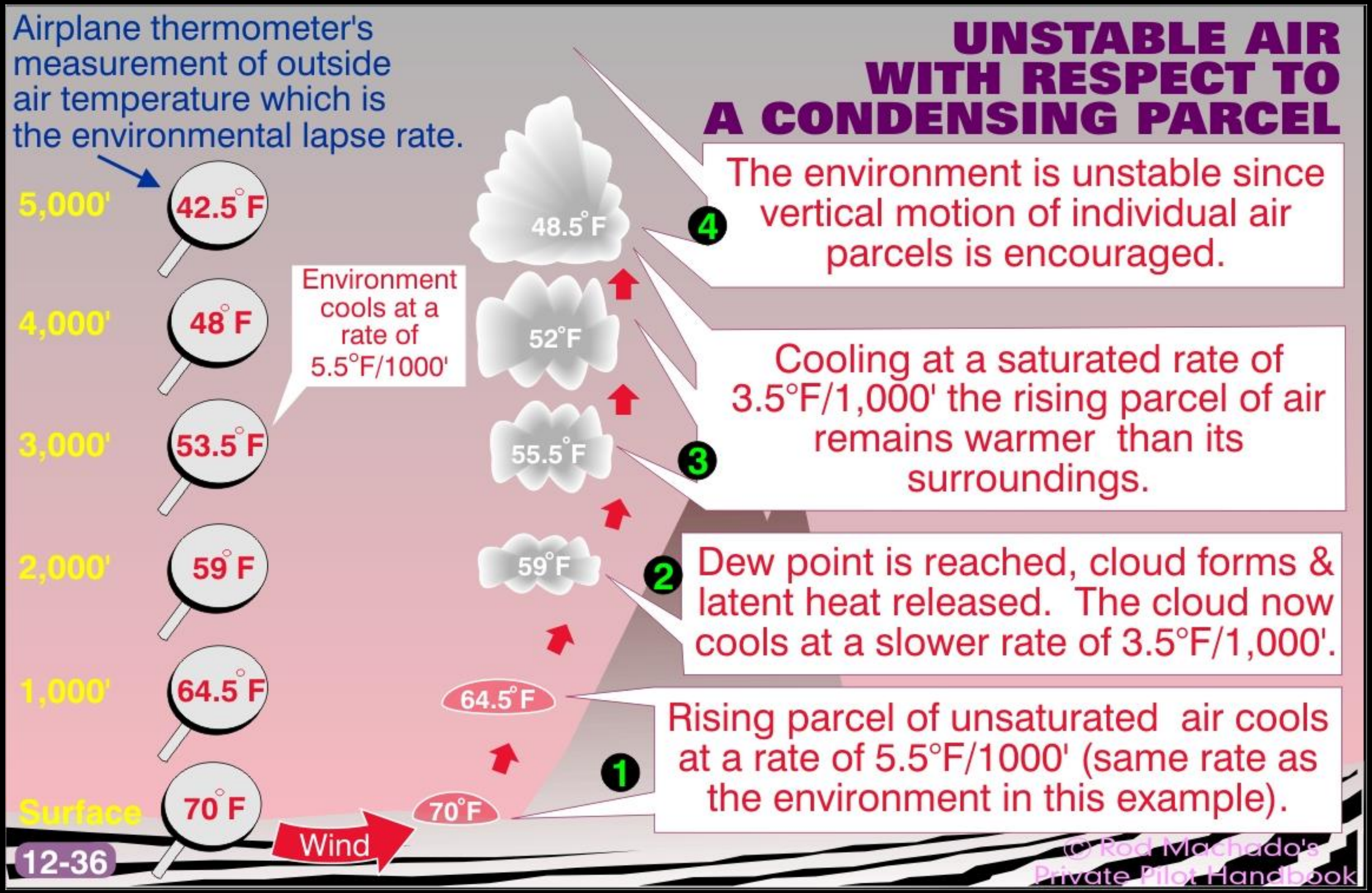


Saturated Parcels of Rising Air

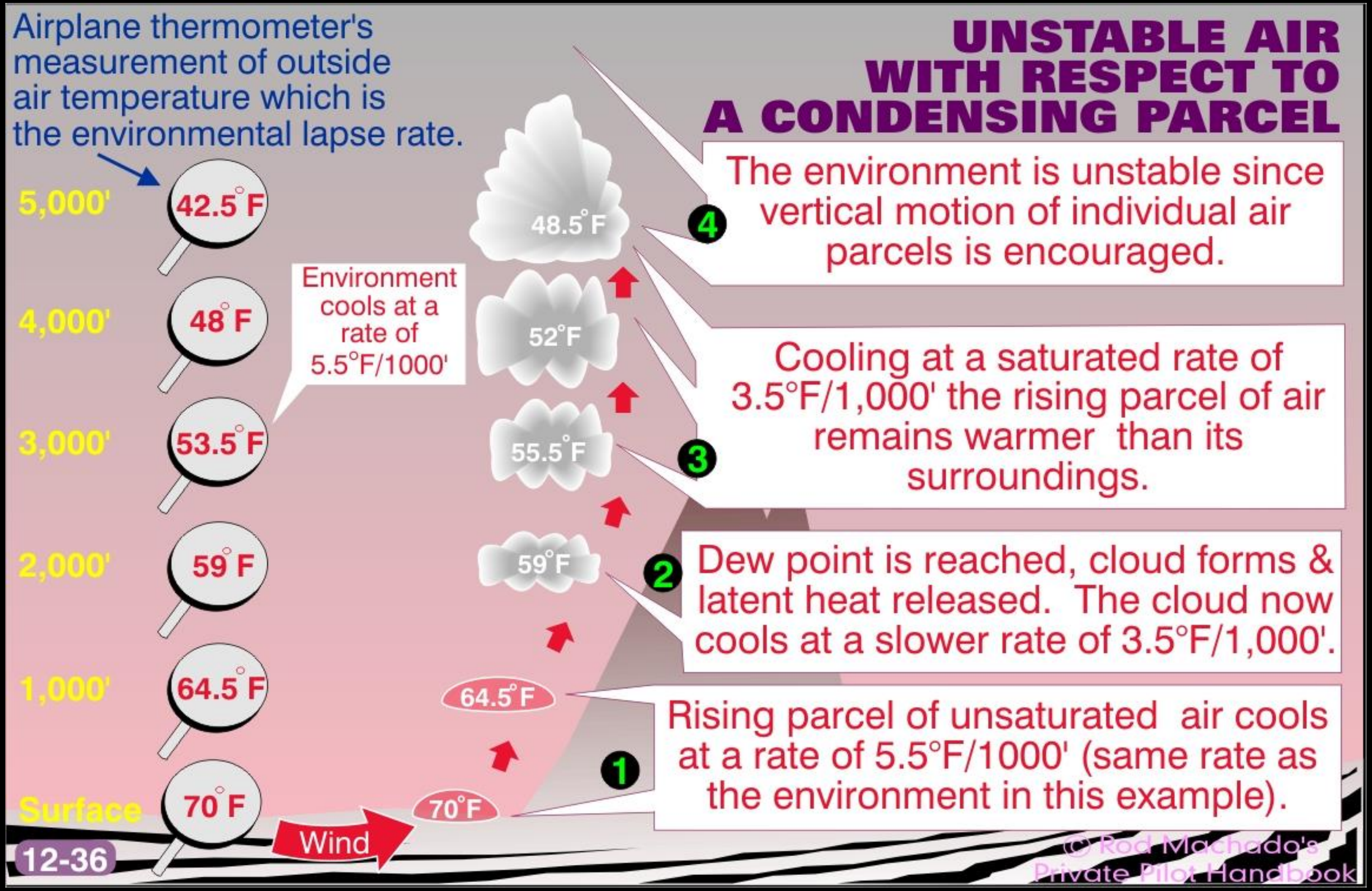
- When rising parcels cool to within a few degrees of their dew point, condensation occurs and clouds form
- When clouds form, heat is released as the water goes from vapor to visible moisture
- This latent heat gets released into the atmosphere
- An air parcel condensing into clouds doesn't cool as quickly as one that isn't saturated
- Saturated parcels of air cool at rates between 2°F and 5°F per thousand feet, depending on how much water vapor (and trapped heat) was in the air to begin with

Rising Parcel of Unsaturated Air

- A rising parcel of unsaturated air (no cloud forming) being moved up a mountain slope
- It cools at the same rate as the environment
- So far the atmosphere (the environment) is neither stable nor unstable; it's neutrally stable



Rising Parcel of Unsaturated Air



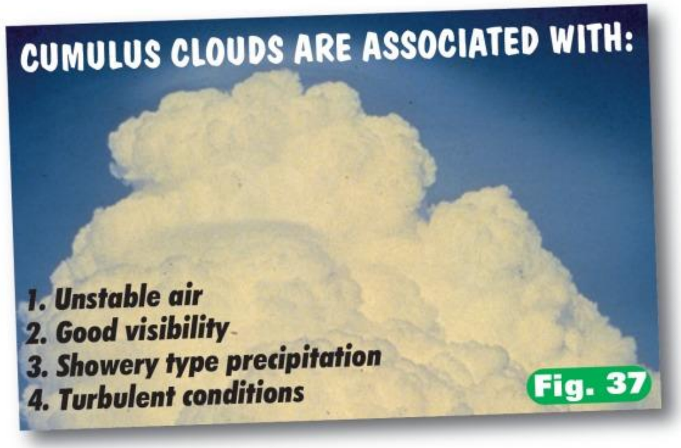
- When parcel becomes saturated (cloud forms) it releases its latent heat which warms the body of the rising parcel (the cloud)
- The cloud remains warmer than its environment since this cloud parcel cools at only 3.5° F per 1,000'
- The parcel now rises on its own without the help of wind
- The atmosphere is now unstable since it encourages the parcel to rise

Clouds and Atmospheric Stability

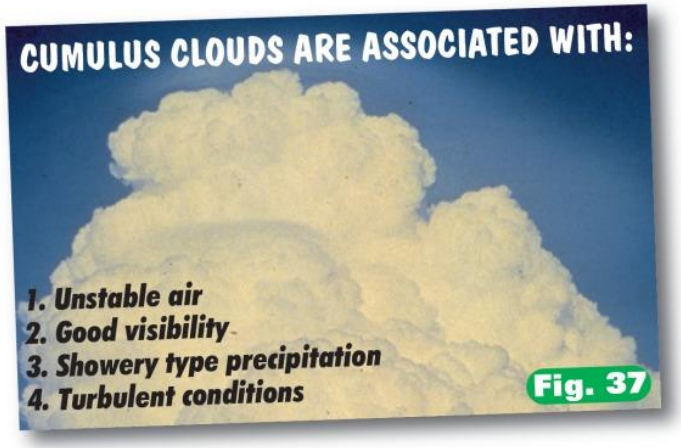
- Cumulus clouds are associated with unstable air
- Stratus clouds go with stable air

Cumulus Clouds

- When an air parcel moves within unstable air its direction is upward
- Cloud formations tend to accumulate vertically
- As these clouds build, they eventually release their condensed water in the form of intermittent, showery-type precipitation
- It’s not unusual to see rain appear beneath a cumulus and, shortly thereafter, disappear



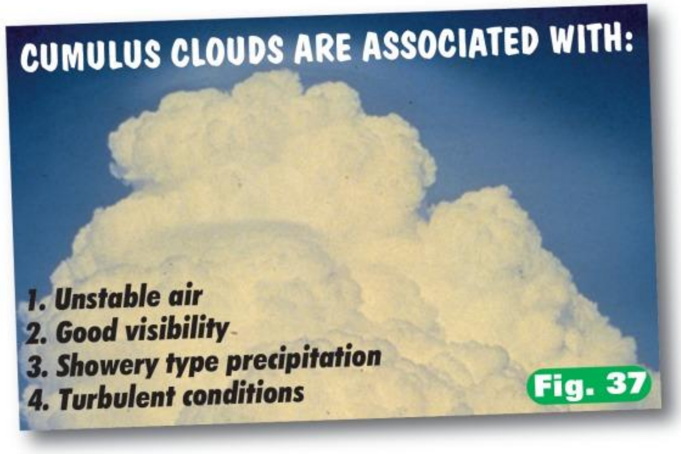
Cumulus Clouds



- Since cumulus clouds form in unstable air, there is a lot of vertical motion in the atmosphere
- Dirt, dust, haze and other pollutants are drawn upward and redistributed to neighboring areas
- Cumulus clouds normally correlate with good visibility
- This vertical motion produces turbulence which is a common phenomenon near or under cumulus clouds

Stratus Clouds

- When an air parcel moves in stable air movement is more horizontal than vertical
- The parcel doesn't develop the temperature difference with its environment that encourages vertical motion
- Stratus, or straight layered type, clouds develop

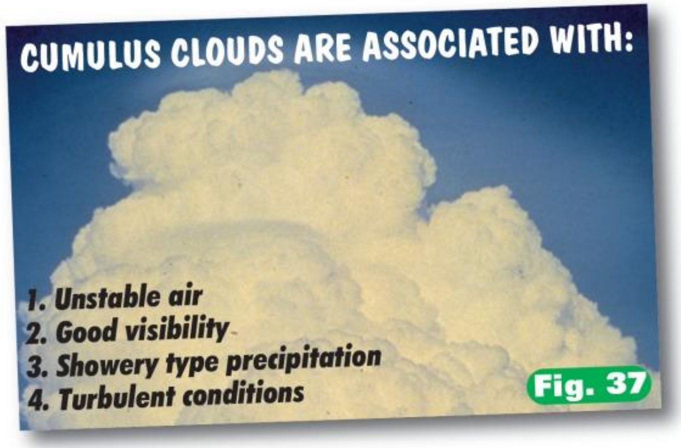


Stratus Clouds

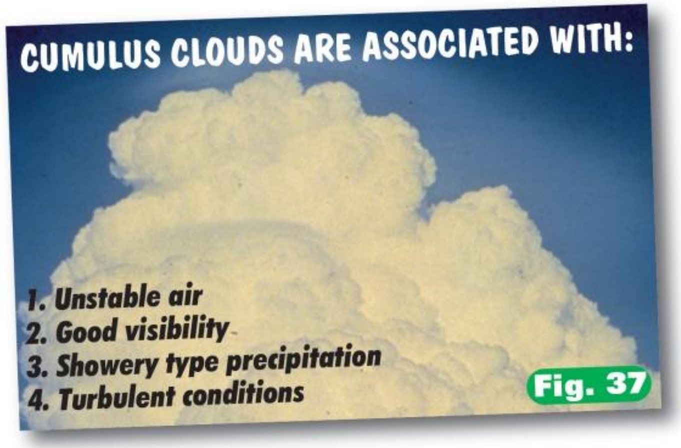
- Are the result of water vapor condensing in air parcels that have little vertical movement
- If the atmosphere becomes warmer with height (an inversion), parcels of warm air are prevented from rising
- Since these air parcels can’t move vertically they tend to be flat on top
- Any cloud tops present will take on a straight or stratified appearance

Stratus Clouds

- Often signal the presence of a temperature inversion
- Limited vertical air movement in stable air means poor visibility
- Pollutants, dust, dirt, and haze become trapped under the inversion



Stratus Clouds



- Precipitation is usually in the form of a continuous type of drizzle
- Contain smaller water droplets than those in cumulus clouds
- Usually cover a wider area for a longer period of time

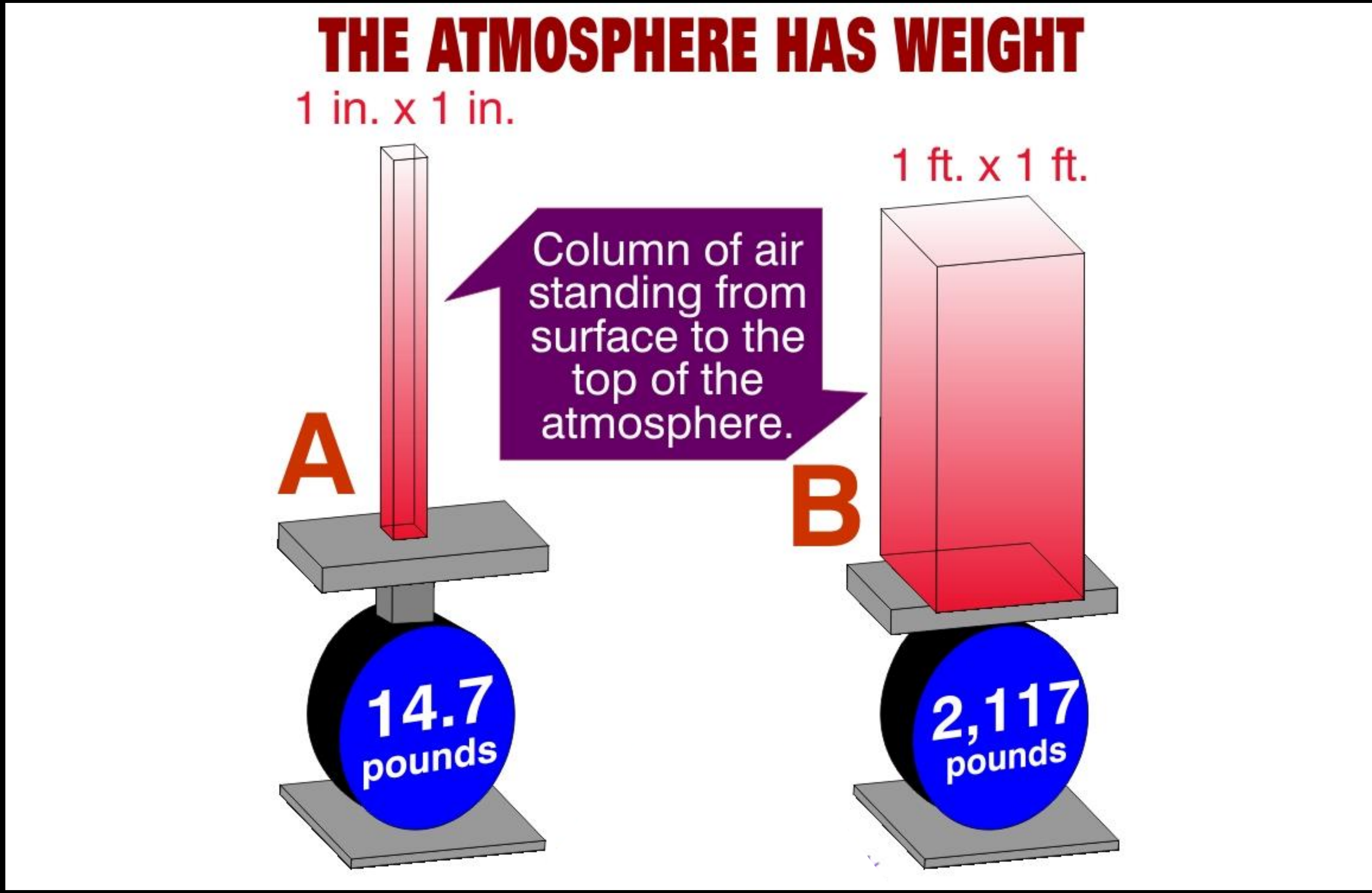
Determining Base of Convective Clouds

- ***What is the approximate base of the cumulus clouds if the surface temperature at 1000 feet MSL is 70°F and the dew point is 48°F?***
- An estimate of convective cloud bases can be found by dividing the convergence into the temperature spread:
  - 1. (70 – 48) ÷ 4.4 = 5.0 × 1,000 = 5,000 feet AGL base
  - 2. 1,000 feet MSL + 5,000 feet AGL = 6,000 feet MSL

- In a convection current, the temperature and dew point converge at about 4.4°F per 1,000 feet
- $\frac{T - DP}{4.4}$ X *1000 = Base*

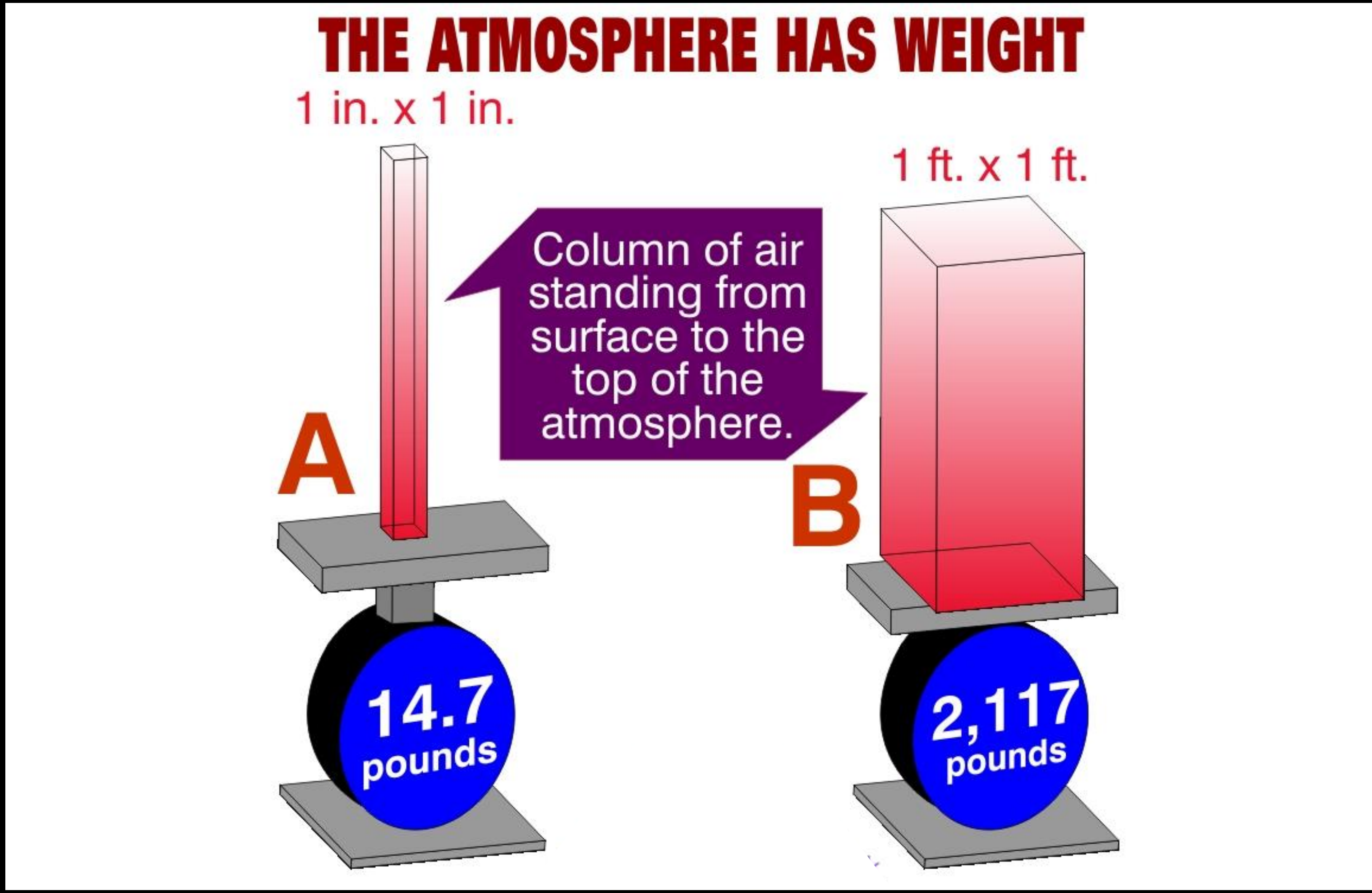
Air Has Weight

- The atmosphere is composed of countless air molecules
- Each air molecule is affected by gravity
- This is why air has weight
- At the earth's surface, air pushes down with a pressure of 14.7 pounds for every square inch



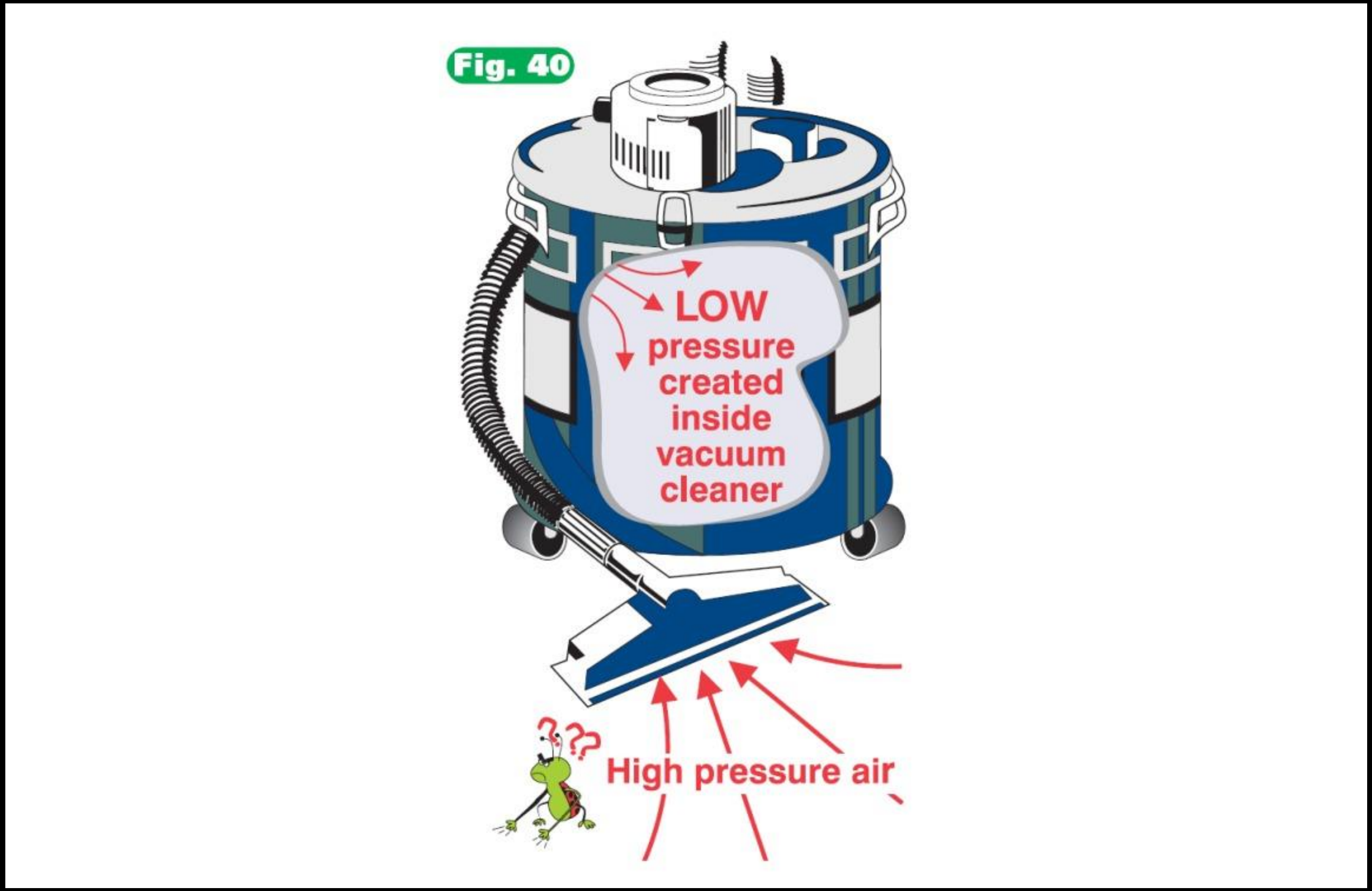
Air Has Weight

- One square inch of air standing from the earth's surface to the top of the atmosphere weighs 14.7 pounds
- This produces 14.7 pounds per square inch of pressure on the surface
- A square foot of air standing the same height weighs 2,117 pounds and produces 2,117 pounds per square foot of pressure on the surface



Pressure Differences

- Vacuum cleaners create pressure inside the machine that’s lower than the pressure outside
- Air moves from the area of high pressure (outside the vacuum) to the area of low pressure (inside the vacuum)



Pressure Differences

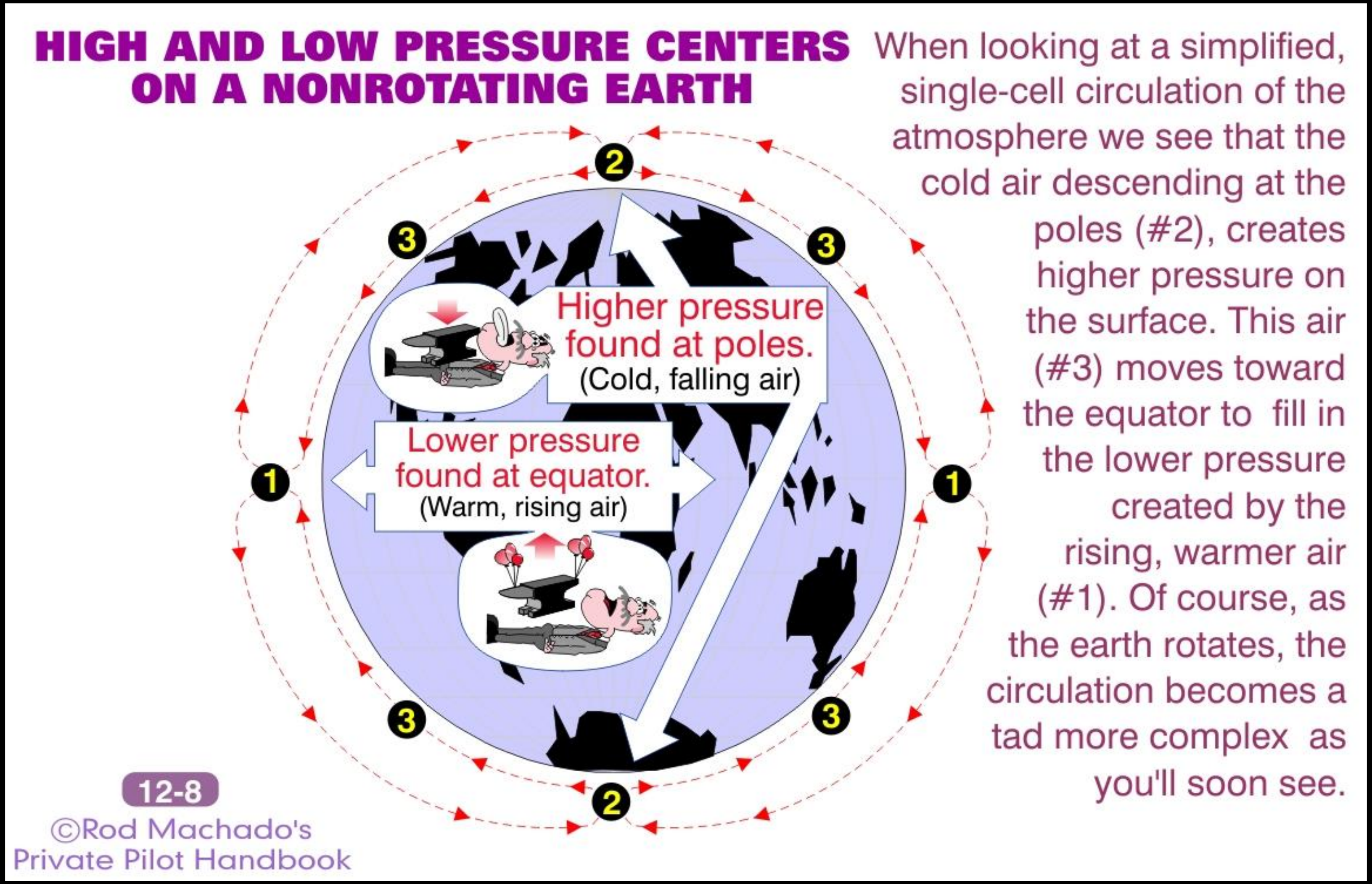
- There is a constant attempt to equalize any temperature and pressure differentials in the atmospheric system
- Pressure differences are another way in which the atmosphere gets moved around creating wind and weather

Pressure Differences

- While gravity provides a constant pull on the air, the atmosphere still experiences variations in the pressure it exerts on the earth’s surface
- Sometimes, individual sections of air are forced upward or downward
- Changes in atmospheric pressure are felt at the surface of the earth

Rising and Descending Air

- Air over the north pole is cooled and sinks
- As the cool, descending air pushes on the surface its weight is felt as higher atmospheric pressure
- Conversely, at the equator air is heated by warm surface temperatures and rises
- Rising air reduces the pressure it exerts on the surface creating extensive areas of low pressure around the globe

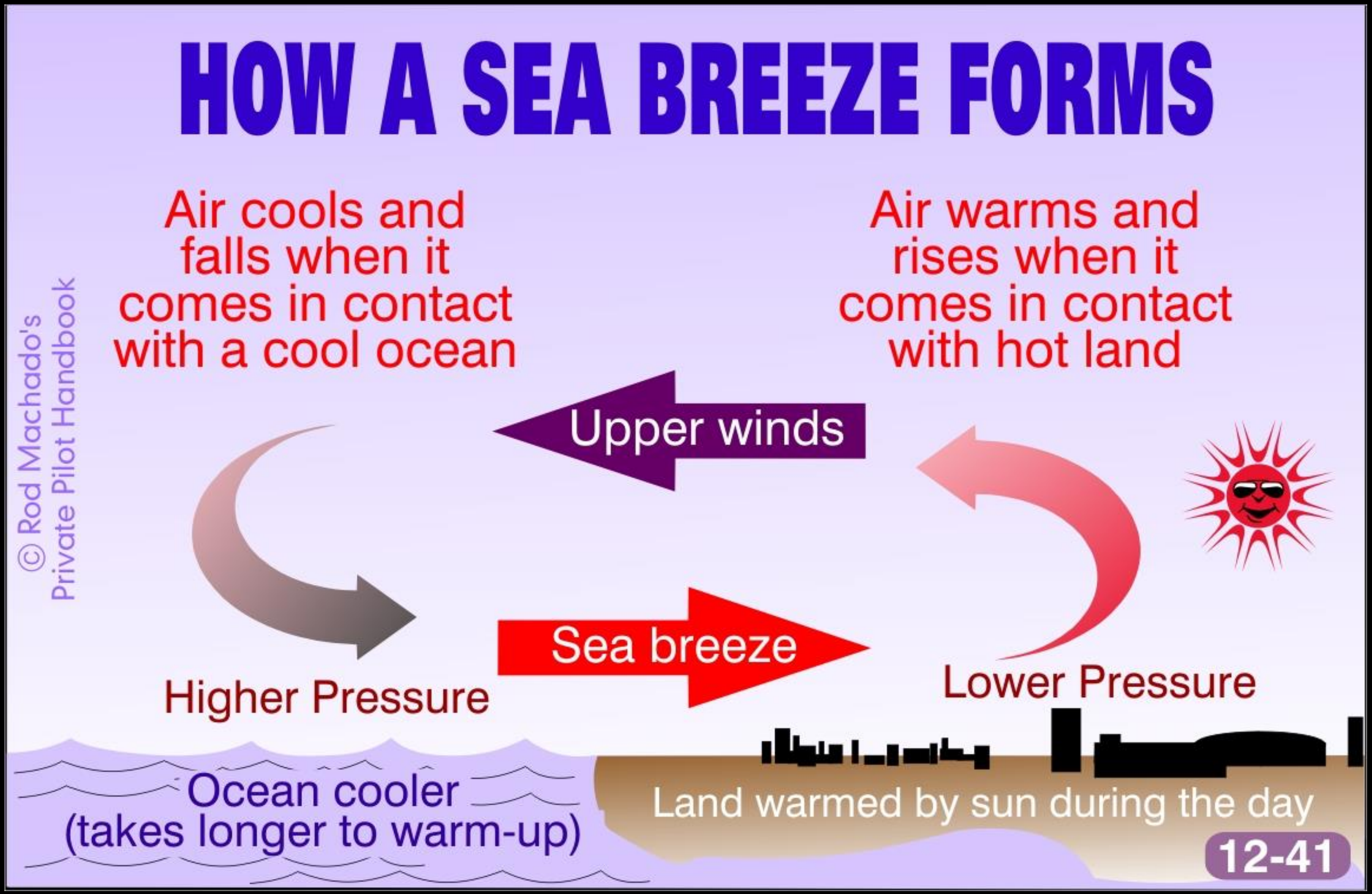


Pressure Differences

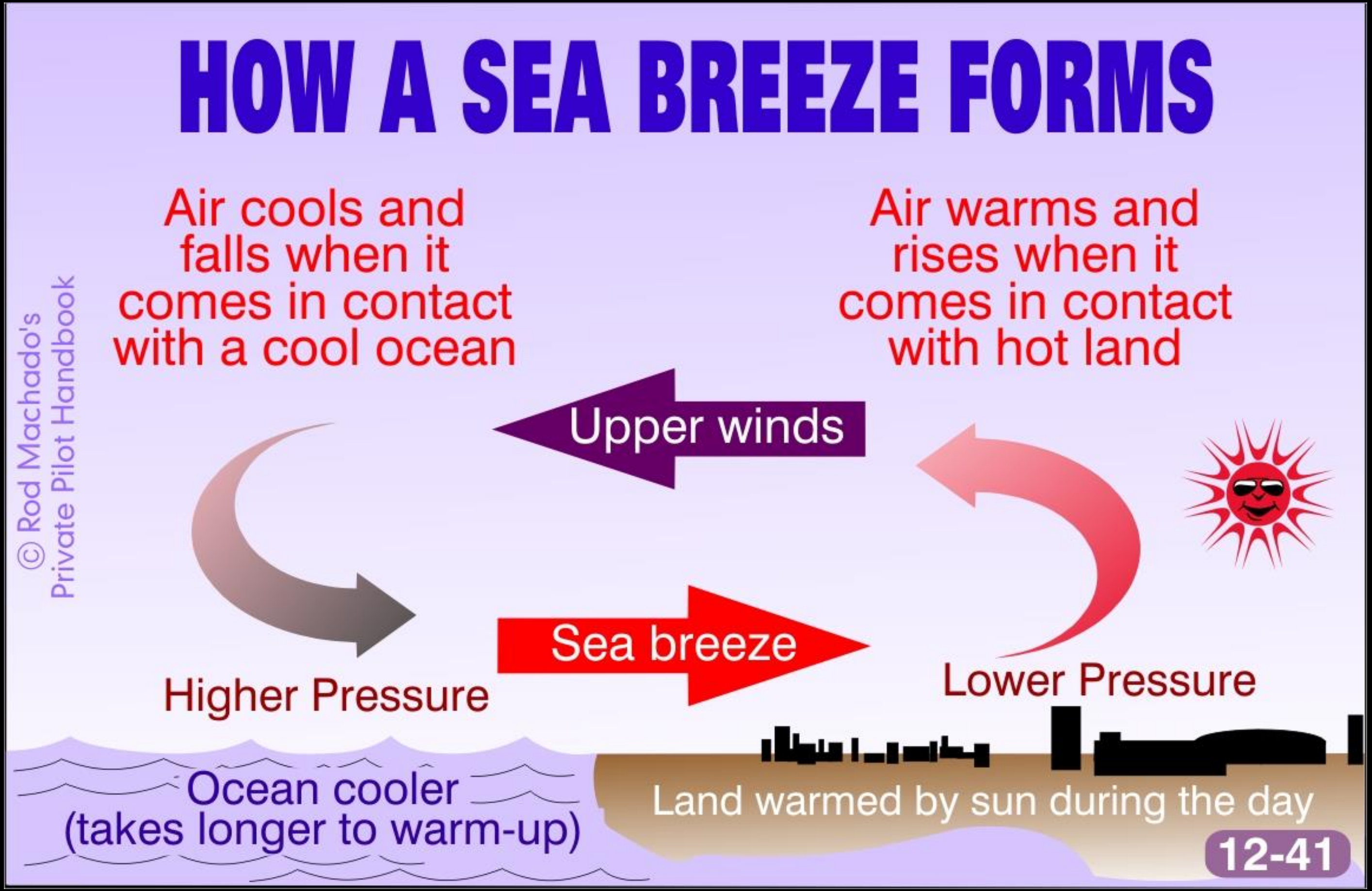
- Variations in temperature over water and land cause changes in atmospheric pressure
- Wherever there’s a differential in the atmosphere nature tries to equalize it
- In the case of pressure, the air moves from areas of higher pressure to areas of lower pressure
- This moving air is called wind

Sea Breeze

- Called a sea breeze because that’s the direction from which the air blows
- Forms because land warms faster than water
- Heating the land heats air lying next to it, causing it to rise
- This creates a small landbased low pressure area



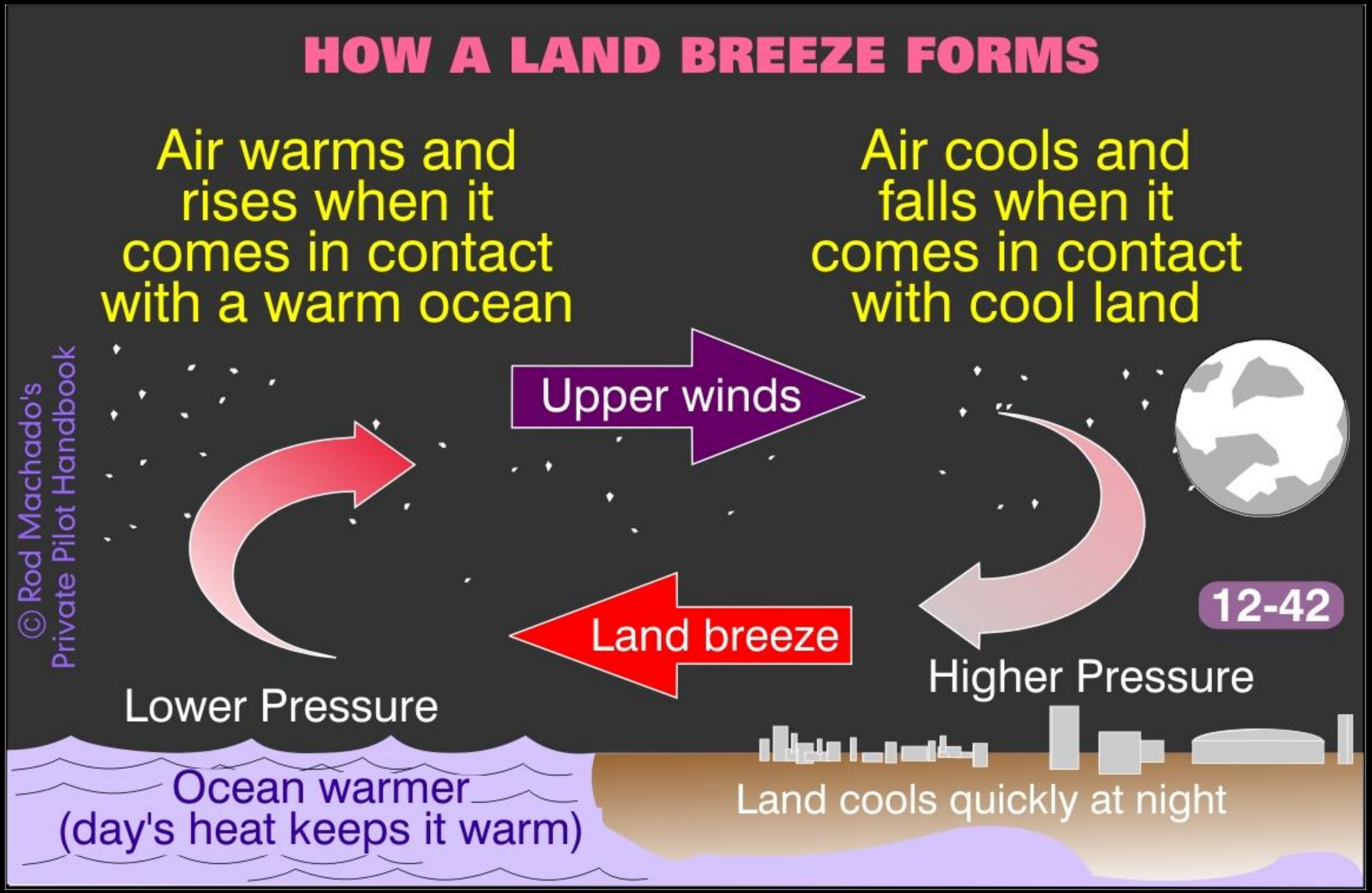
Sea Breeze



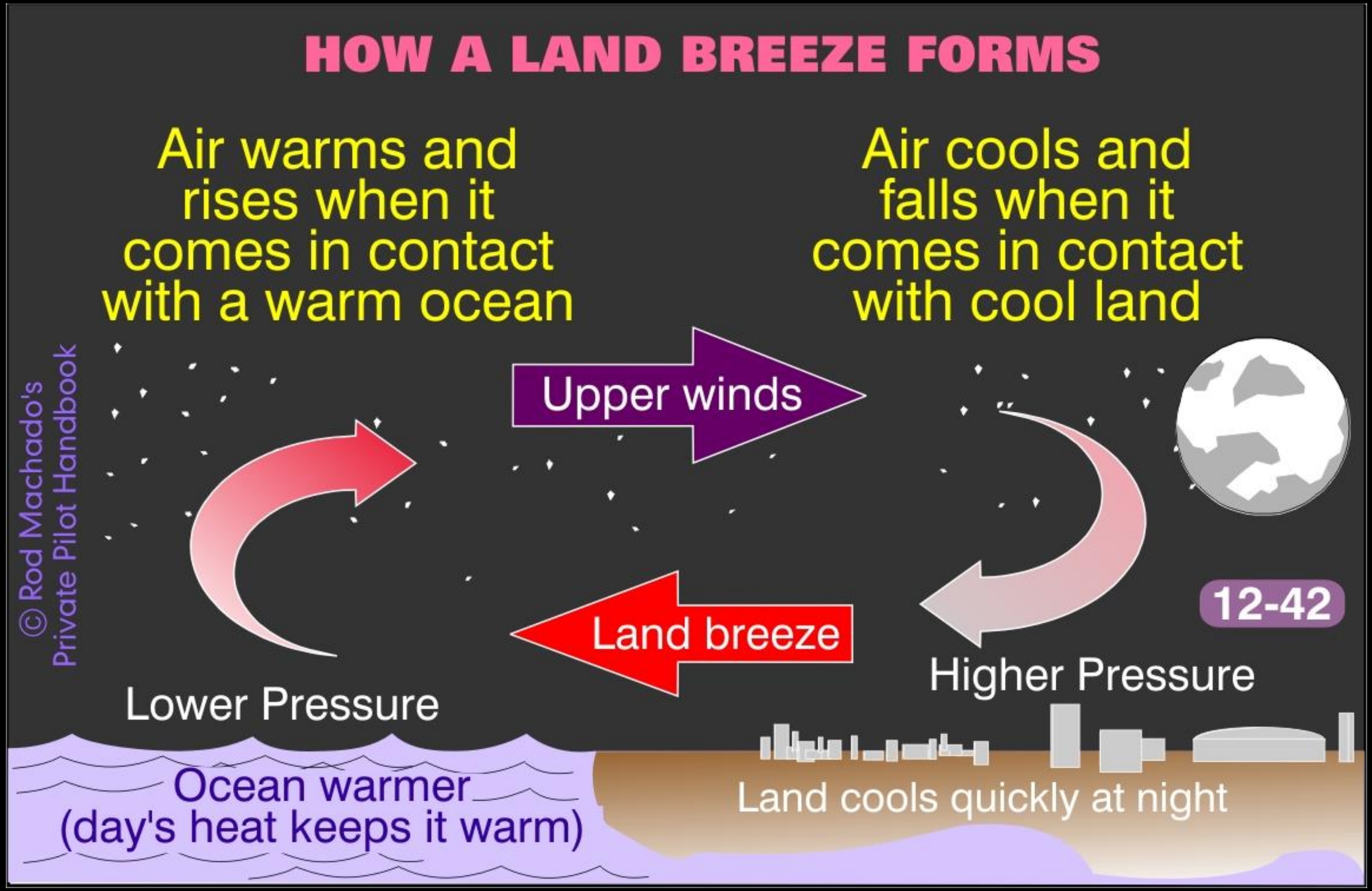
- Air rising over the land cools by expansion and moves toward the ocean, where it begins to settle
- It continues to cool (becomes heavier) as it makes contact with the cool water, forming an area of high pressure over the ocean
- Higher pressure over the ocean forces air to move toward land, creating a breeze from the sea
- A single-cell circulation pattern is established

Land Breeze

- Later in the evening the land cools and airflow near the beach reverses direction
- After sunset, the ocean retains more of the day's heat than the land
- Land isn't heated to the depth water is, so it has less heat to lose and cools more rapidly

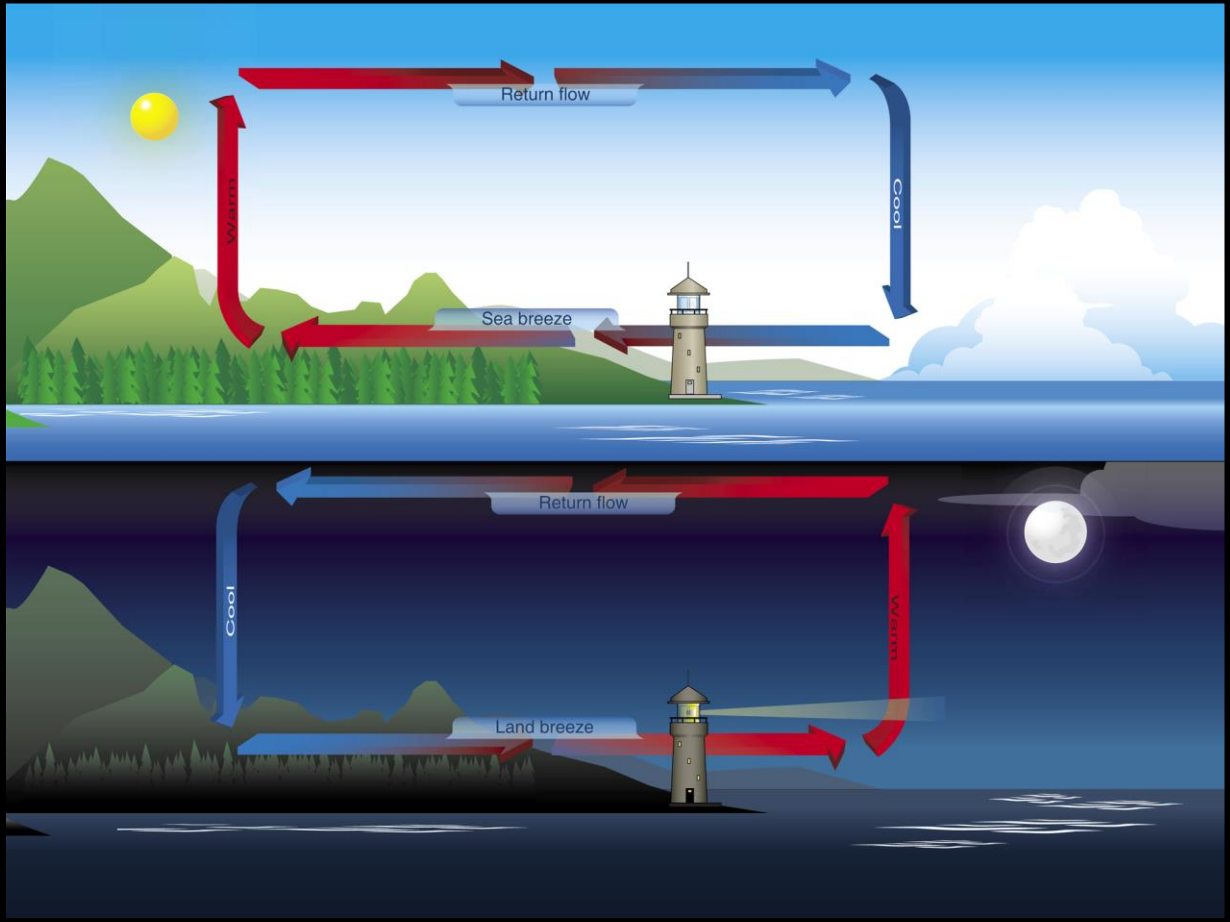


Land Breeze



- In the late evening hours, the low pressure center that was once over land is now over the water
- High pressure now exists over the land where the air has cooled
- A land breeze (blowing from the land) forms and airflow moves toward the water
- The original single-cell circulation pattern is reversed

Sea and Land Breeze

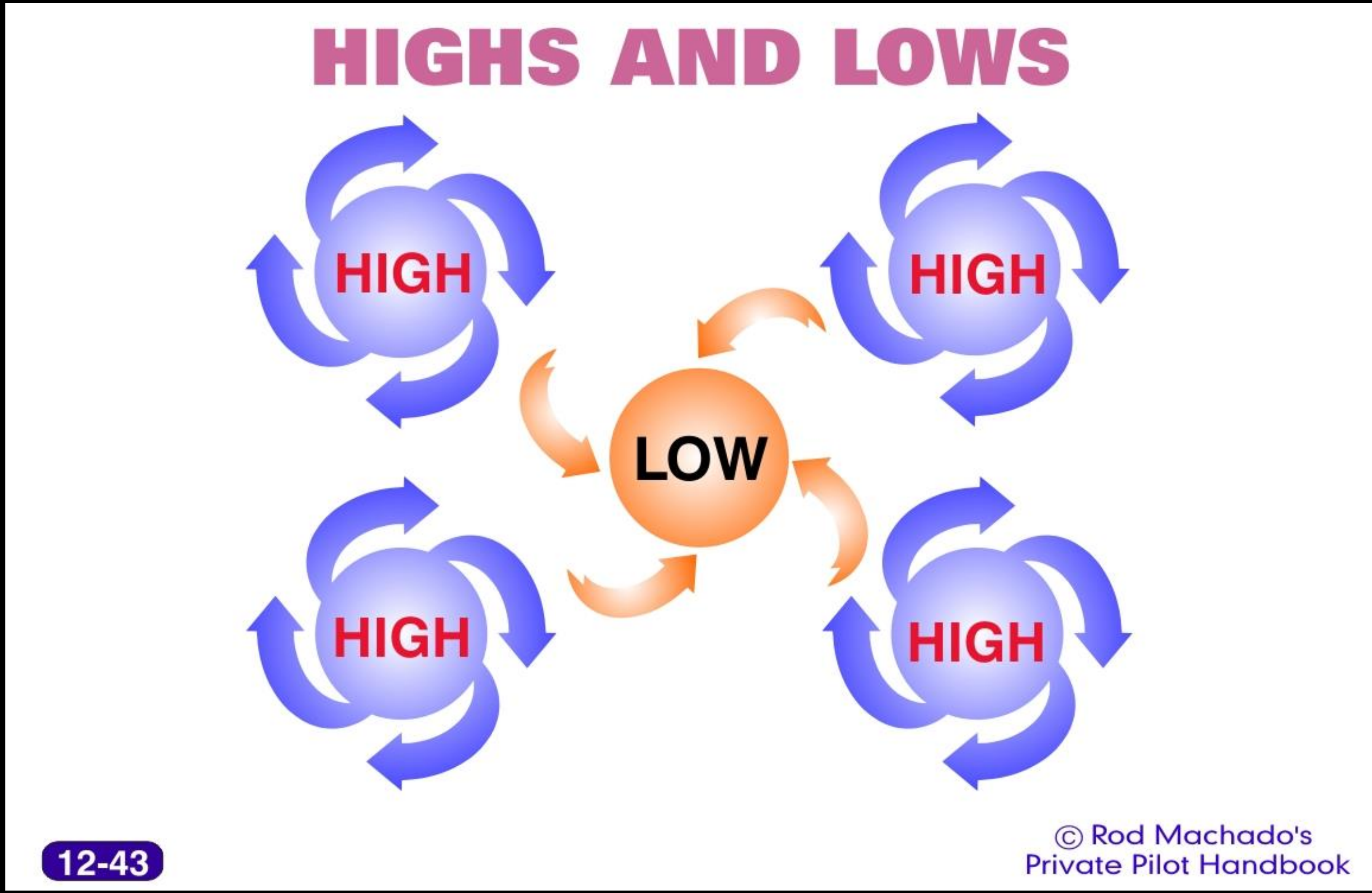


Atmospheric Circulation

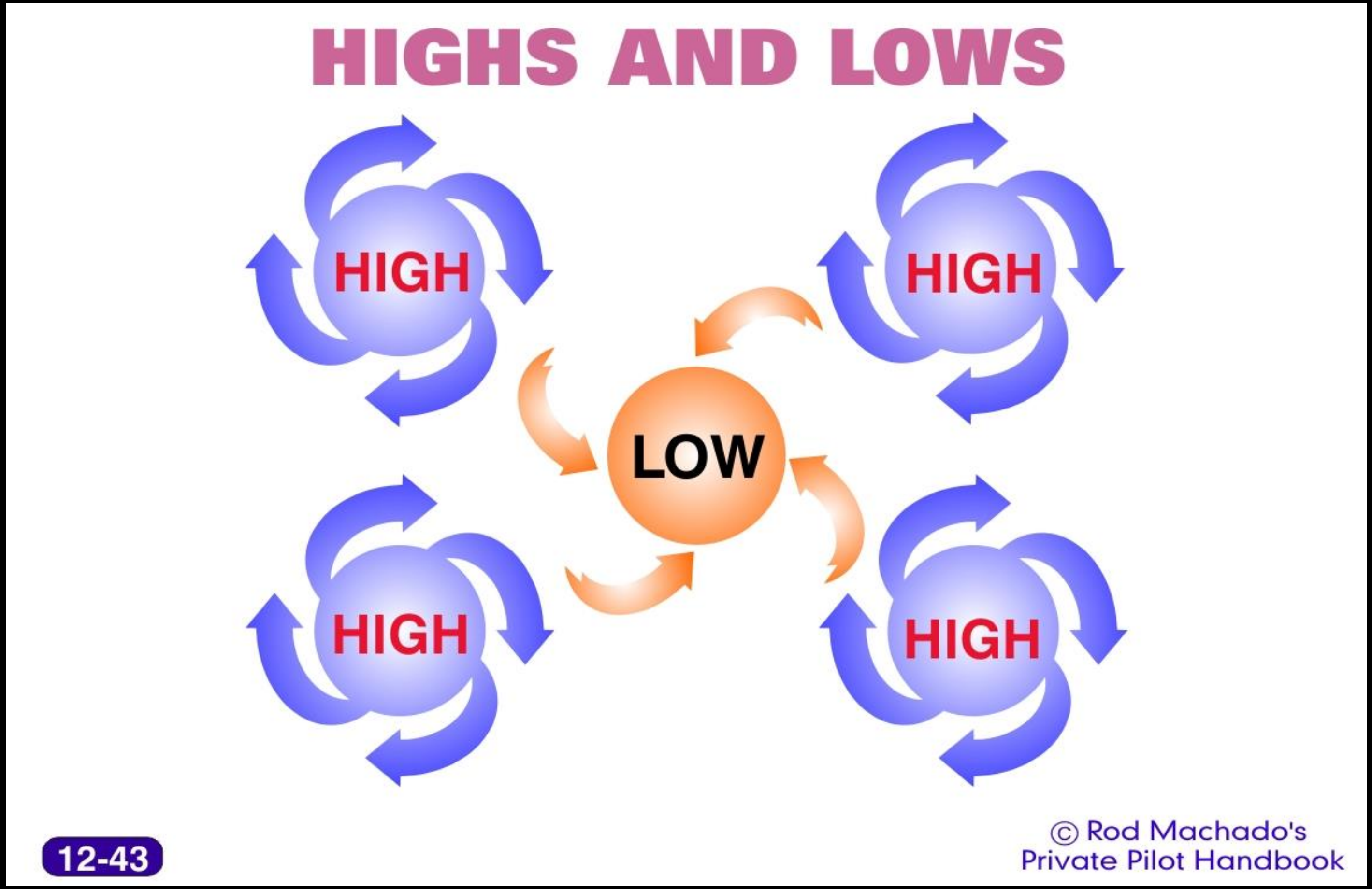
- Land and sea breezes are miniature models of atmospheric circulation

Pressure Centers

- A low pressure center can exist simply because there are several higher pressure centers around it
- If the area surrounding a parcel of air becomes slightly cooler, this makes the central parcel of air warmer, thus lower in pressure by comparison
- Air would then flow in the direction of this lower pressure



Pressure Centers



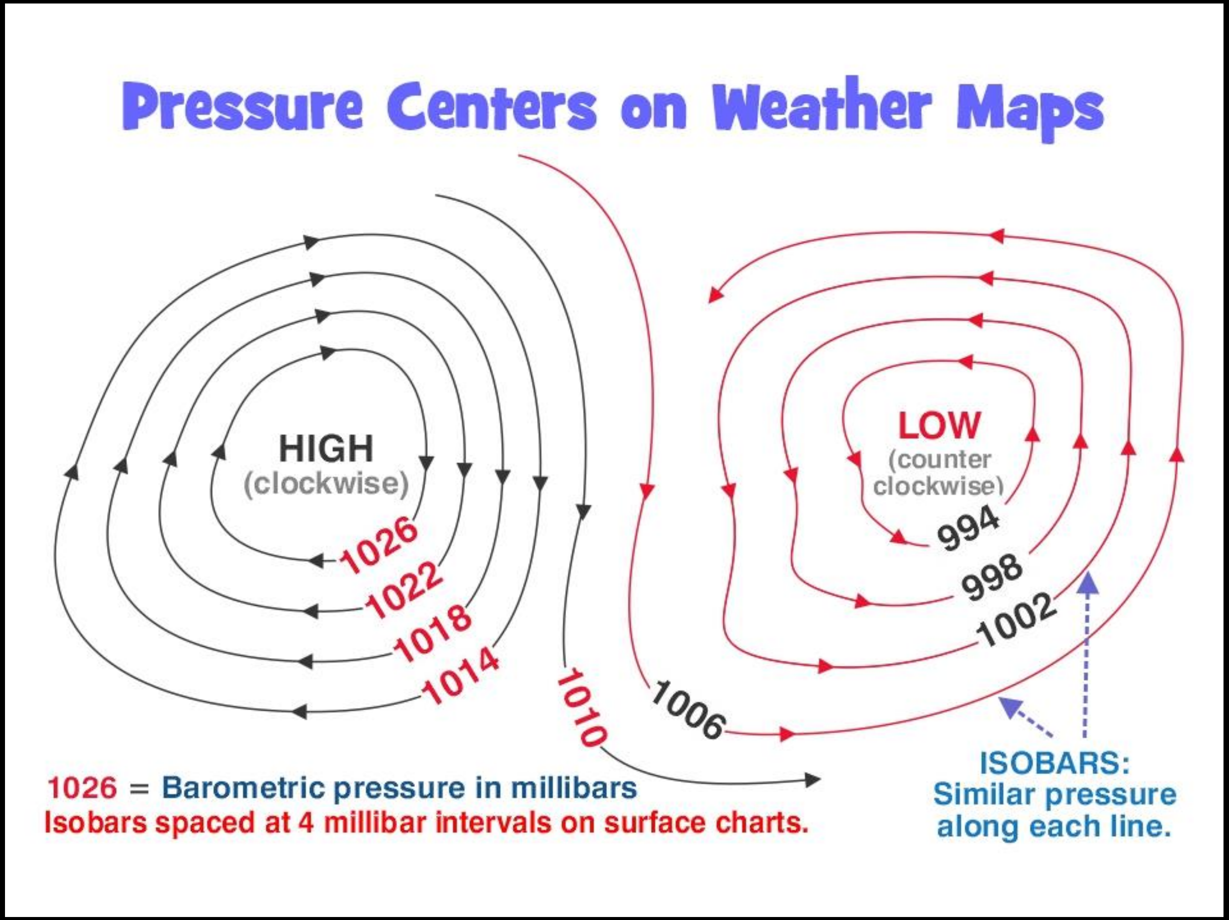
- High and low pressure areas are measured by comparison
- If the center of an air mass is slightly lower in pressure, it makes the surrounding areas higher in pressure
- If the surrounding areas are slightly higher in pressure, it makes the center area lower in pressure

High and Low Pressure Centers

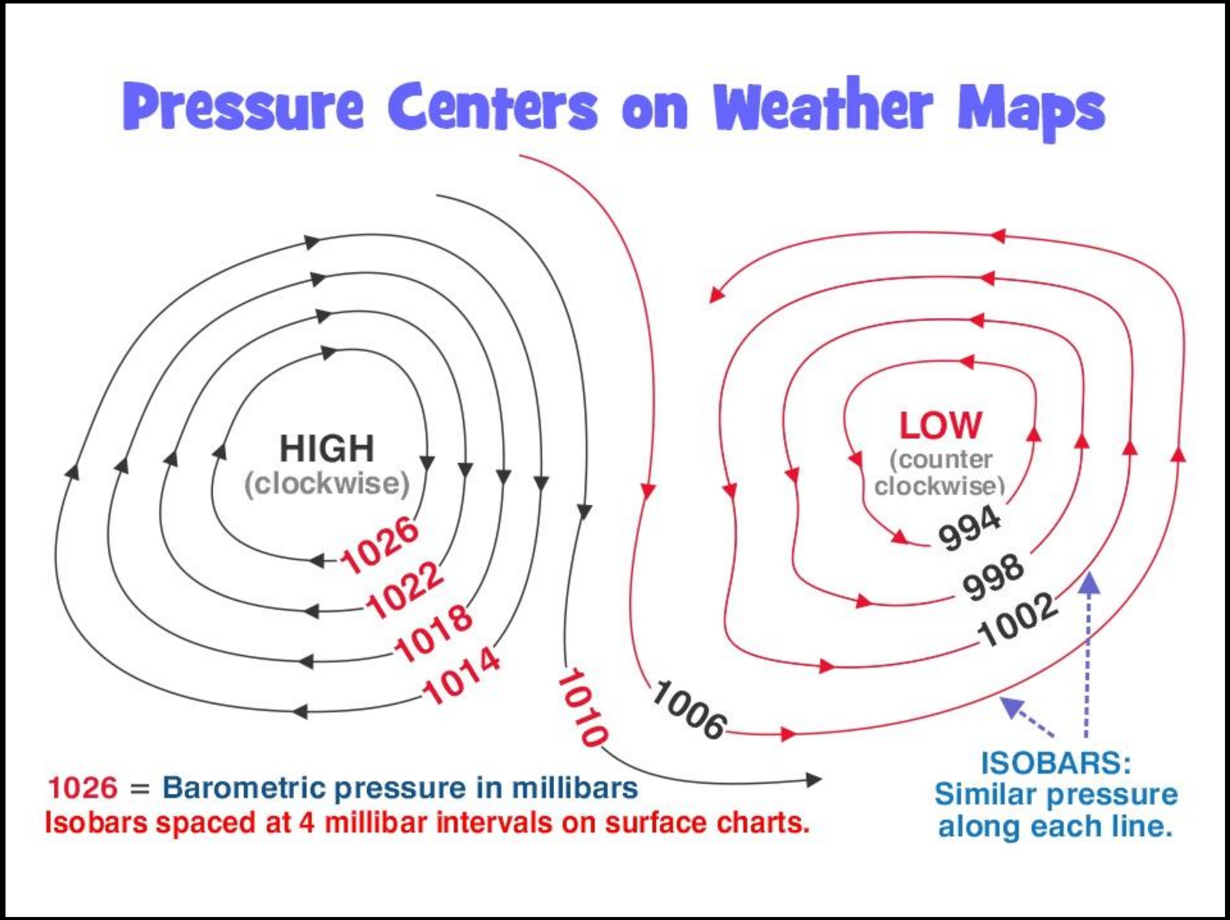
- High and low pressure centers are large masses of air sometimes thousands of miles across that descend and rise slowly
- Within these slowly moving oceans of air, smaller air parcels move up and down as discussed in the stability scenarios
- The environment is constantly changing because high and low pressure air moves
- If the environment is slowly changing, atmospheric stability also changes

Pressure Centers on Weather Maps

- Pressure centers are created by barometric pressure readings from weather stations across the US
- High and low pressure systems are represented by a series of contour lines
- These contour lines surrounding the highs and lows are called isobars
- An isobar is a line connecting areas of equal barometric pressure



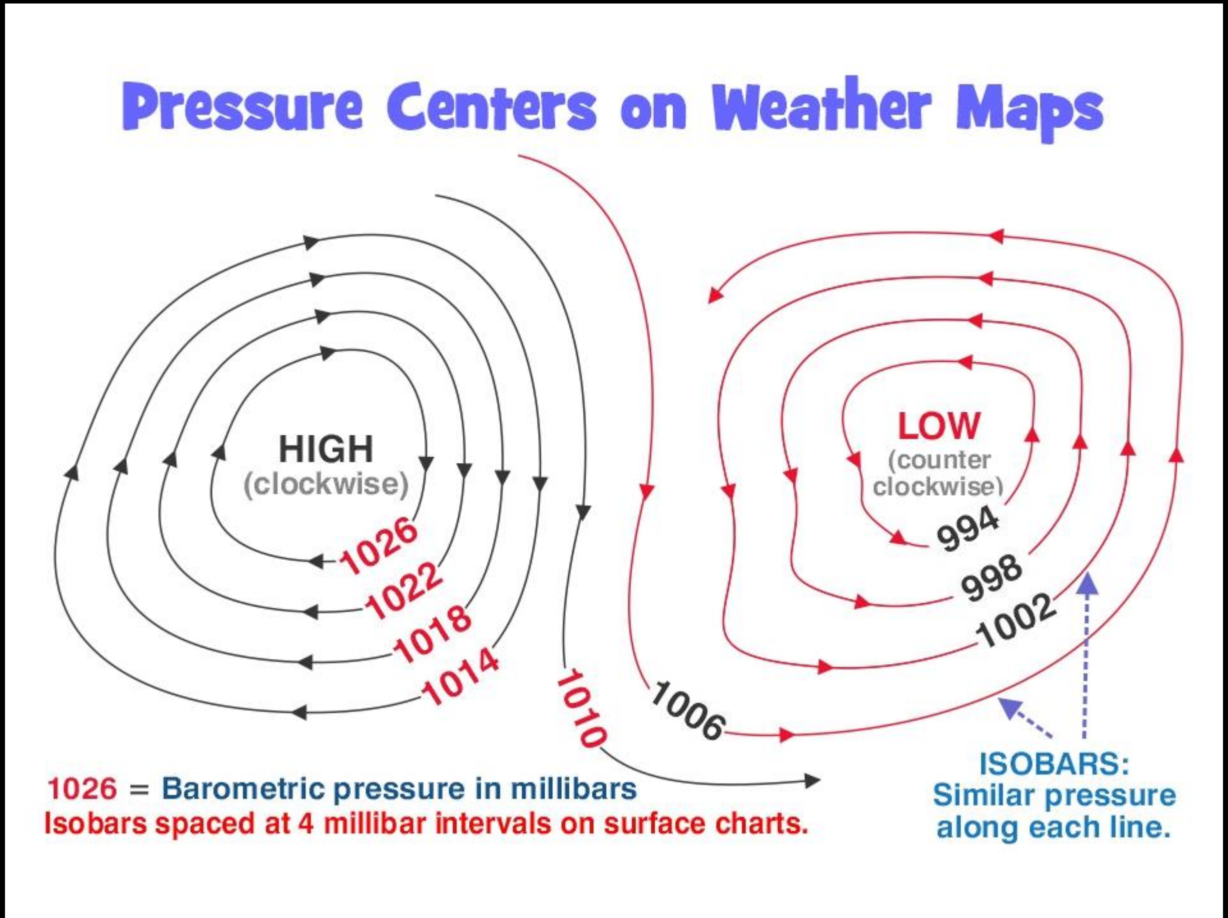
Pressure Centers on Weather Maps



- Like the contour lines on a sectional chart connecting areas of equal altitude
- Iso means equal, and bar represents barometric pressure
- Weather computers automatically connect areas having similar surface pressure with lines
- The result is a pattern depicting atmospheric pressure distribution on a surface weather map

Pressure Centers on Weather Maps

- A pressure value in millibars (international unit of pressure) is placed along each isobar
- The isobar in the very center of the high pressure system depicted connects all areas having a pressure of 1,026 mb
- Moving toward lower pressure (anywhere away from the high’s center), the pressure decreases until the isobar connects pressure of 994 mb in the center of the low



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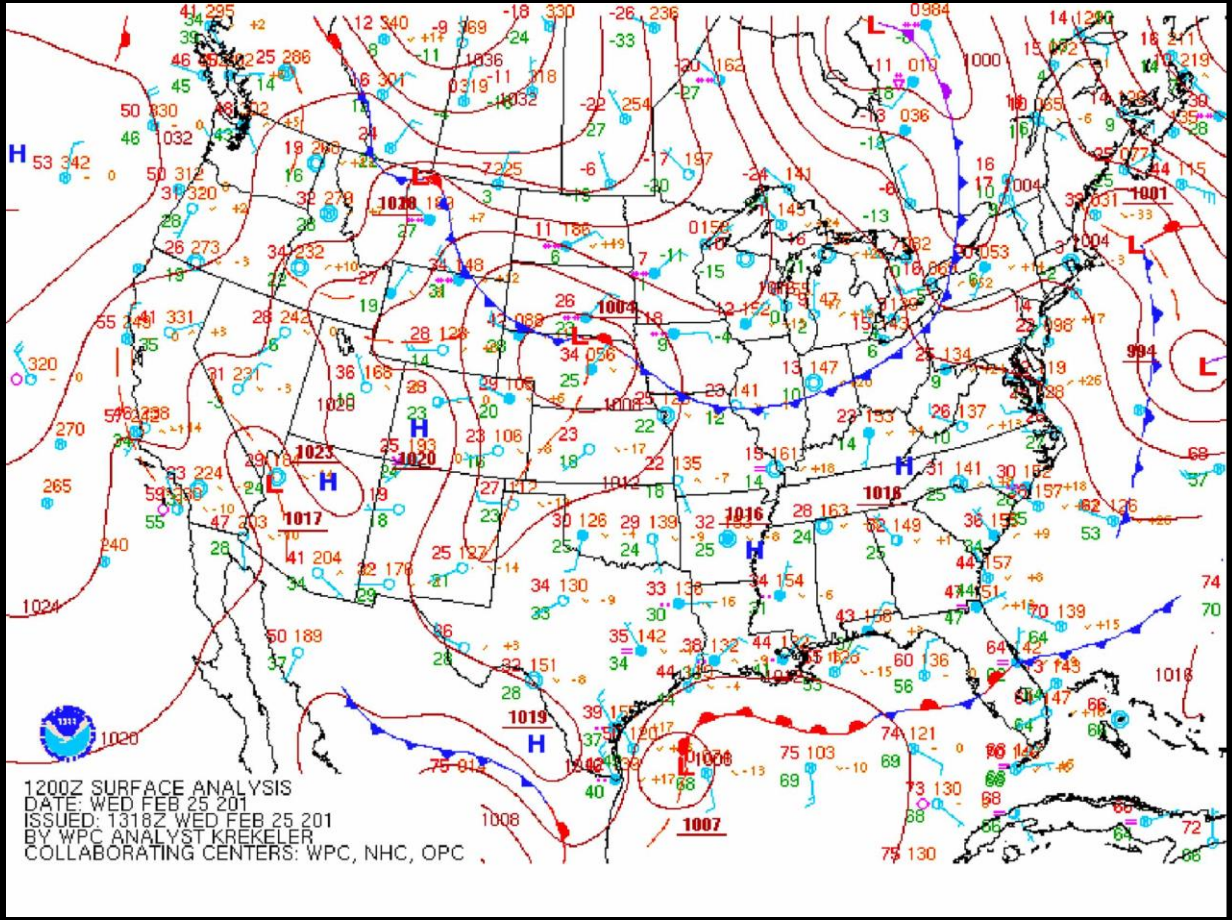
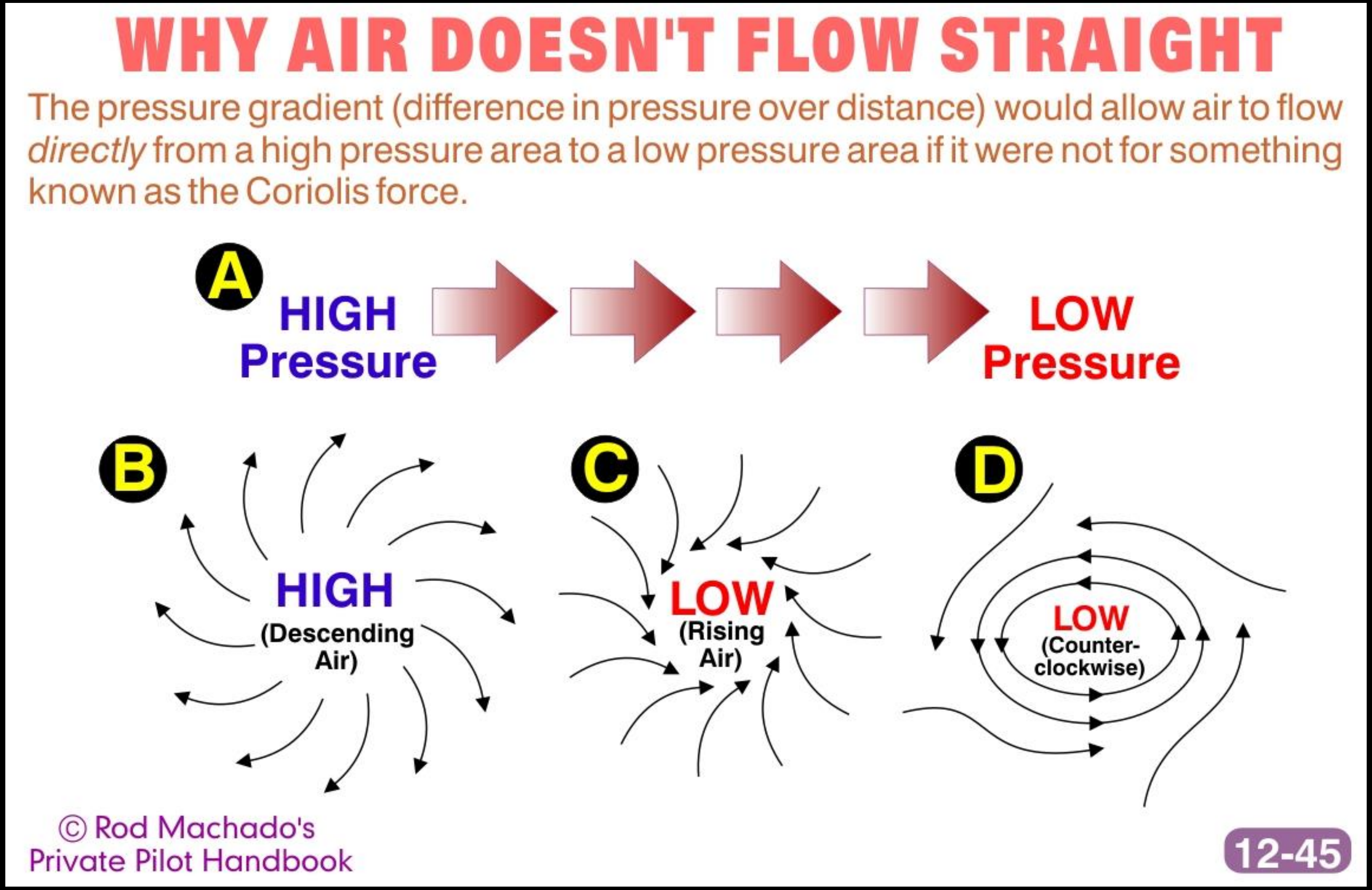


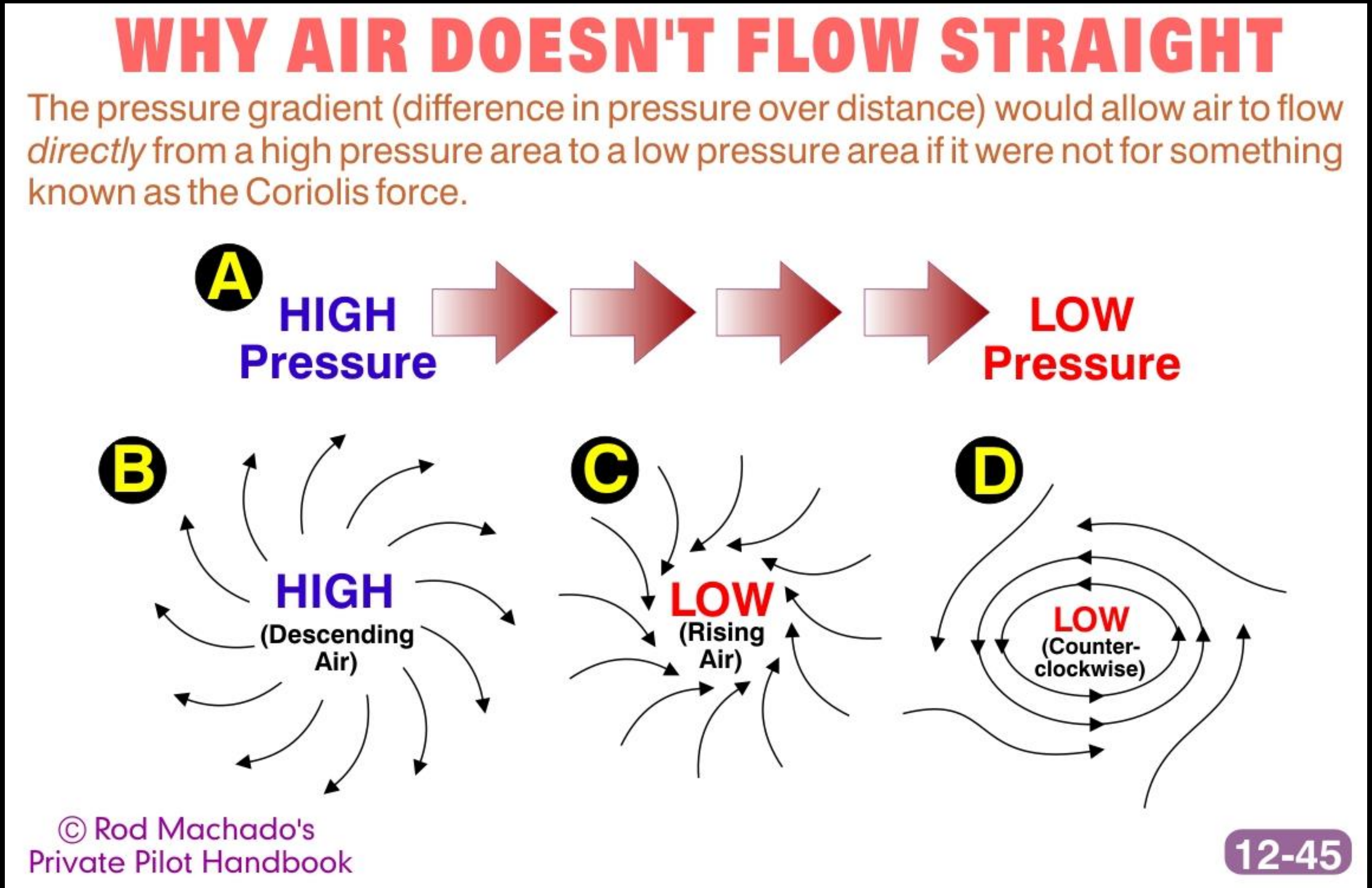
Why Air Doesn't Flow Straight



- Air should flow directly from the high to the low because of the pressure gradient force
- This is the basic pushing force exerted on the air, causing it to move from a higher to a lower pressure
- Were it not for the Coriolis force, air would do just that

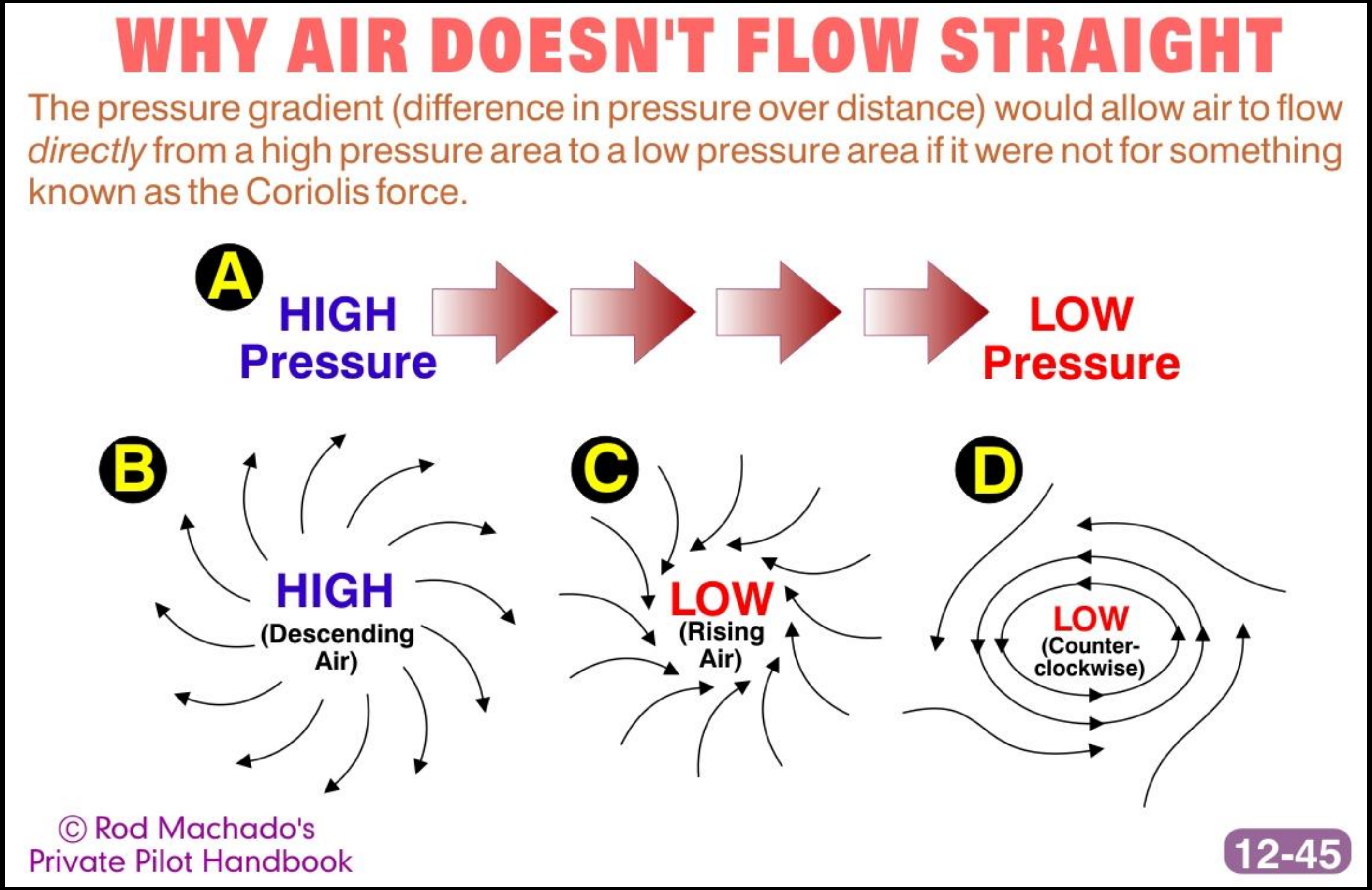
Why Air Doesn’t Flow Straight

- The descending high pressure air settles and spreads outward
- Coriolis force adds a right curve to its motion
- This is why the flow is the clockwise circulation around a high



Why Air Doesn't Flow Straight

- The low pressure system has air converging toward it
- As air moves inward toward the center of the low, the Coriolis force also curves it to the right
- The air is forced into a counterclockwise circulation around the low



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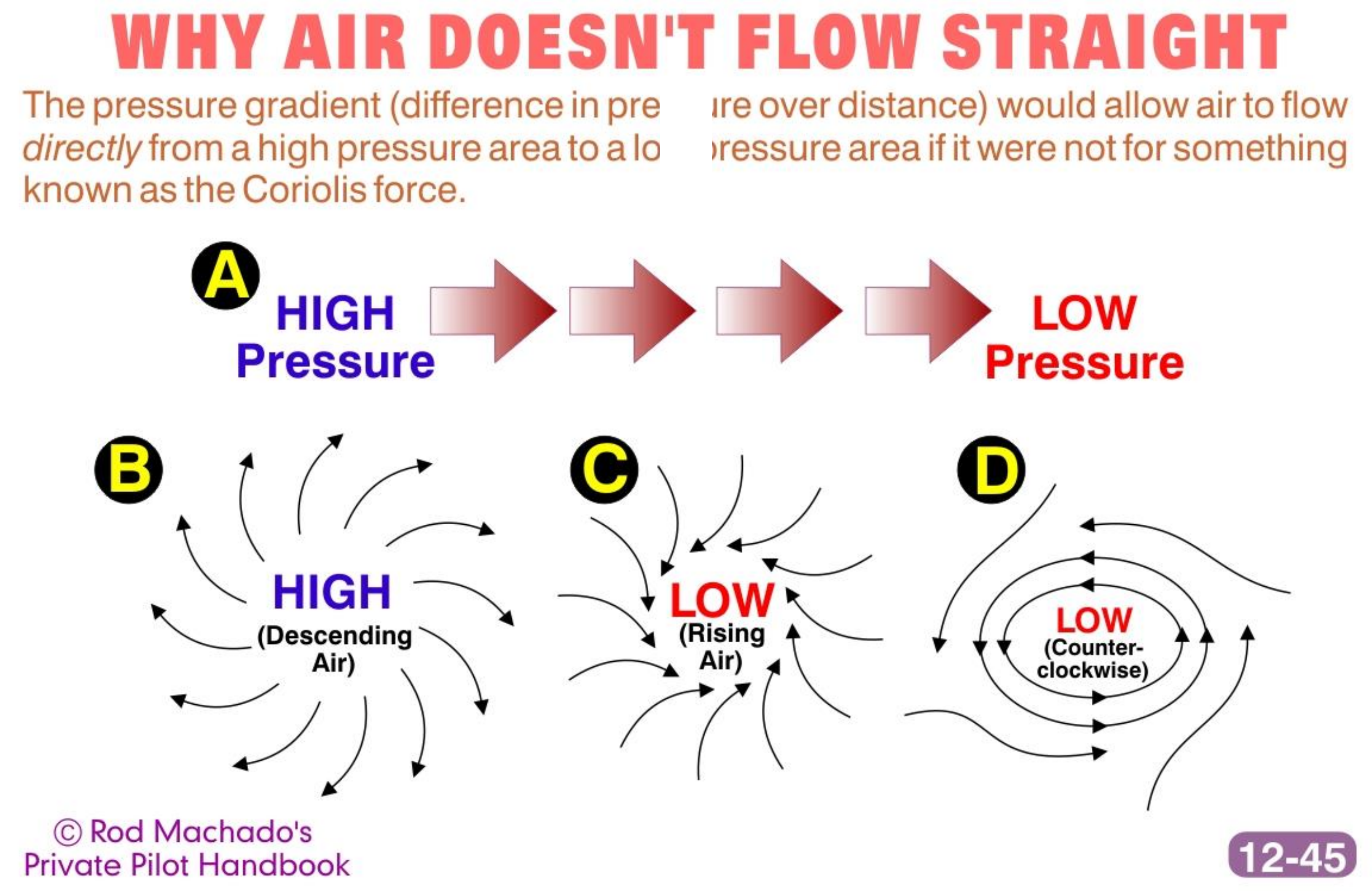
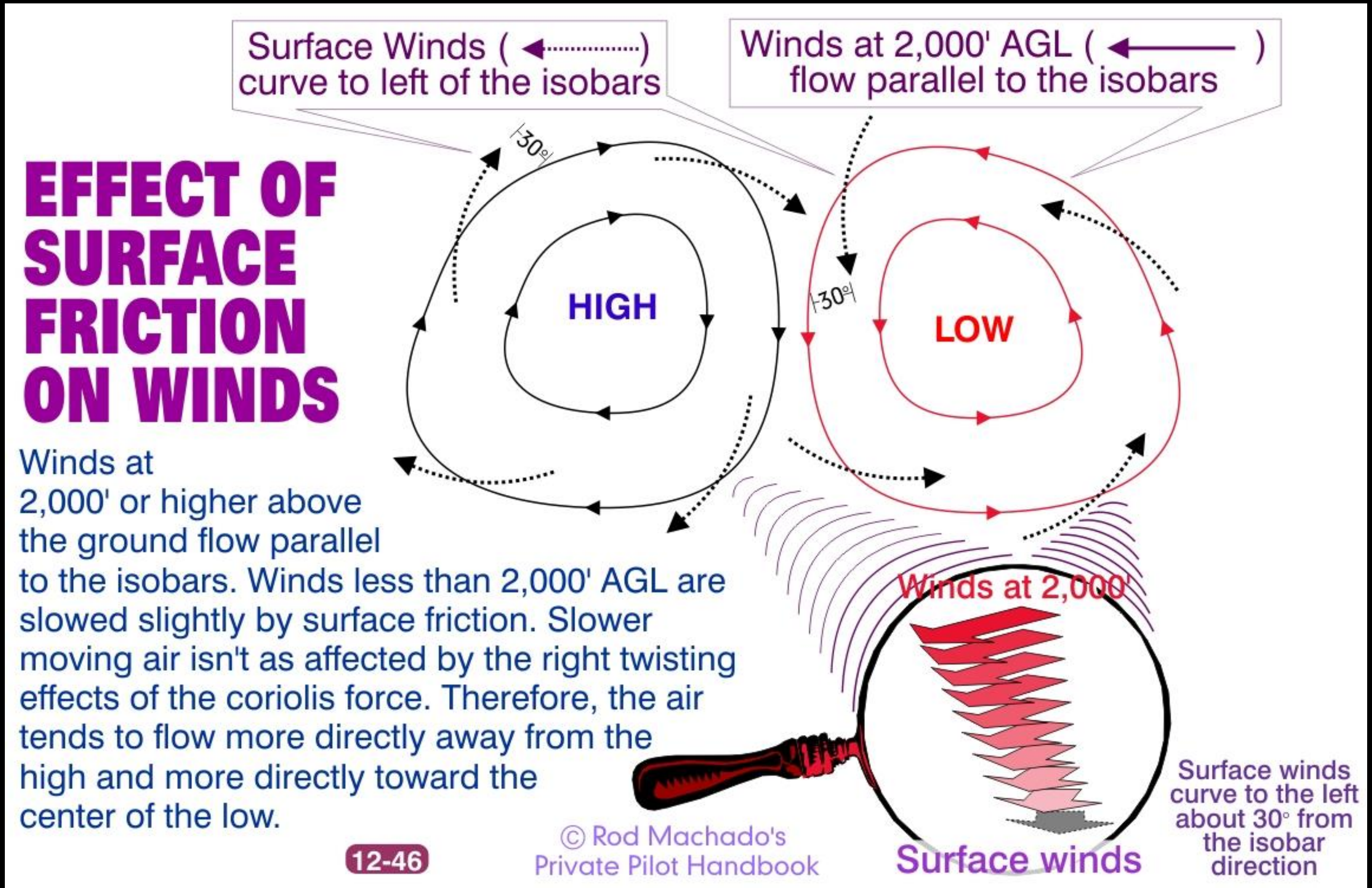


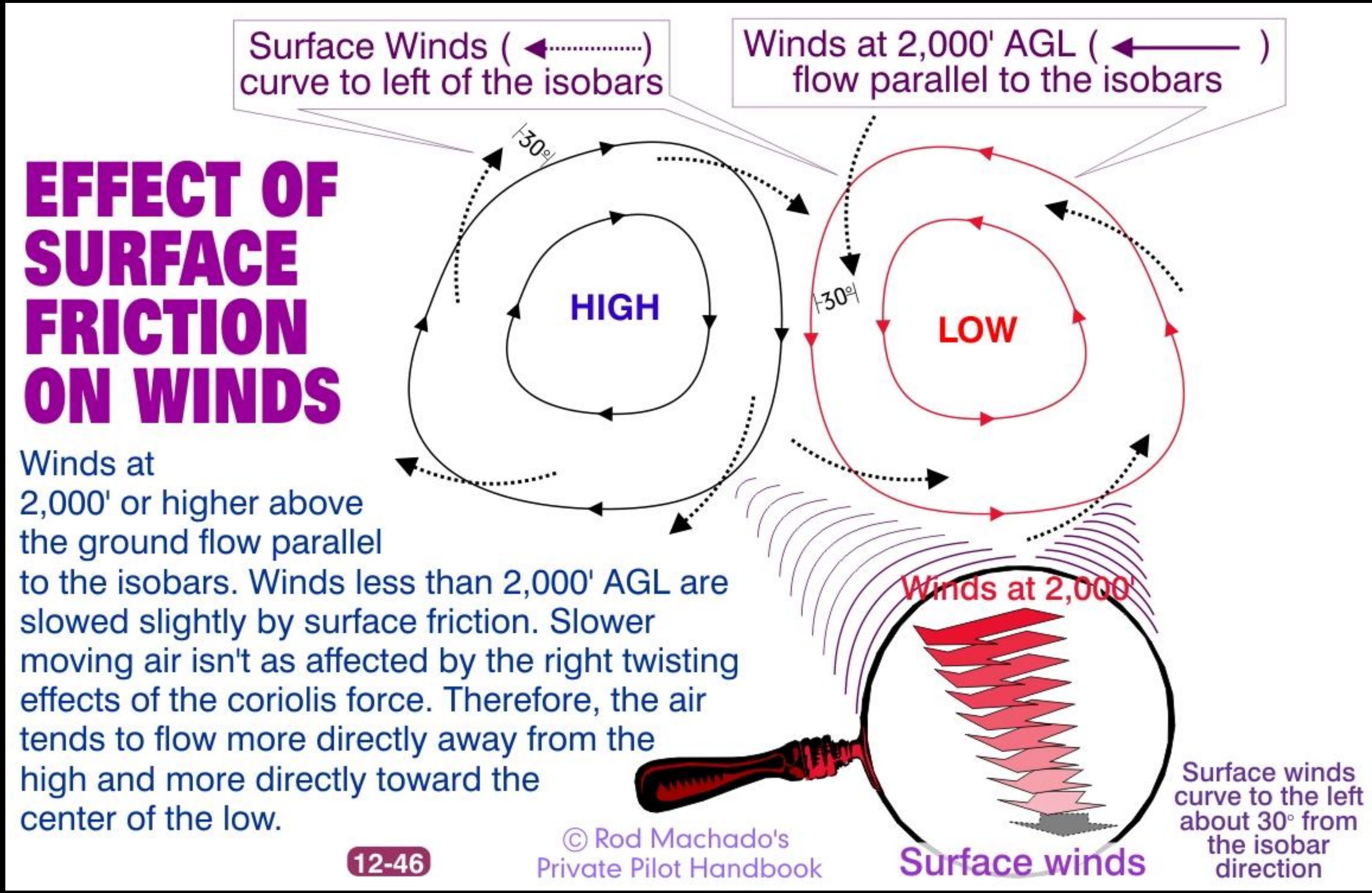
- Because of the pressure gradient and the Coriolis forces air circulation around a high or low flows parallel to the isobars instead of across them

Surface Friction

- Influences winds within 2,000 feet of the surface
- Causes wind speed to decrease as air is slowed by mountains, trees, and other terrain features
- As the air slows down it is less affected by the Coriolis force
- The right curve added to the air diminishes slightly



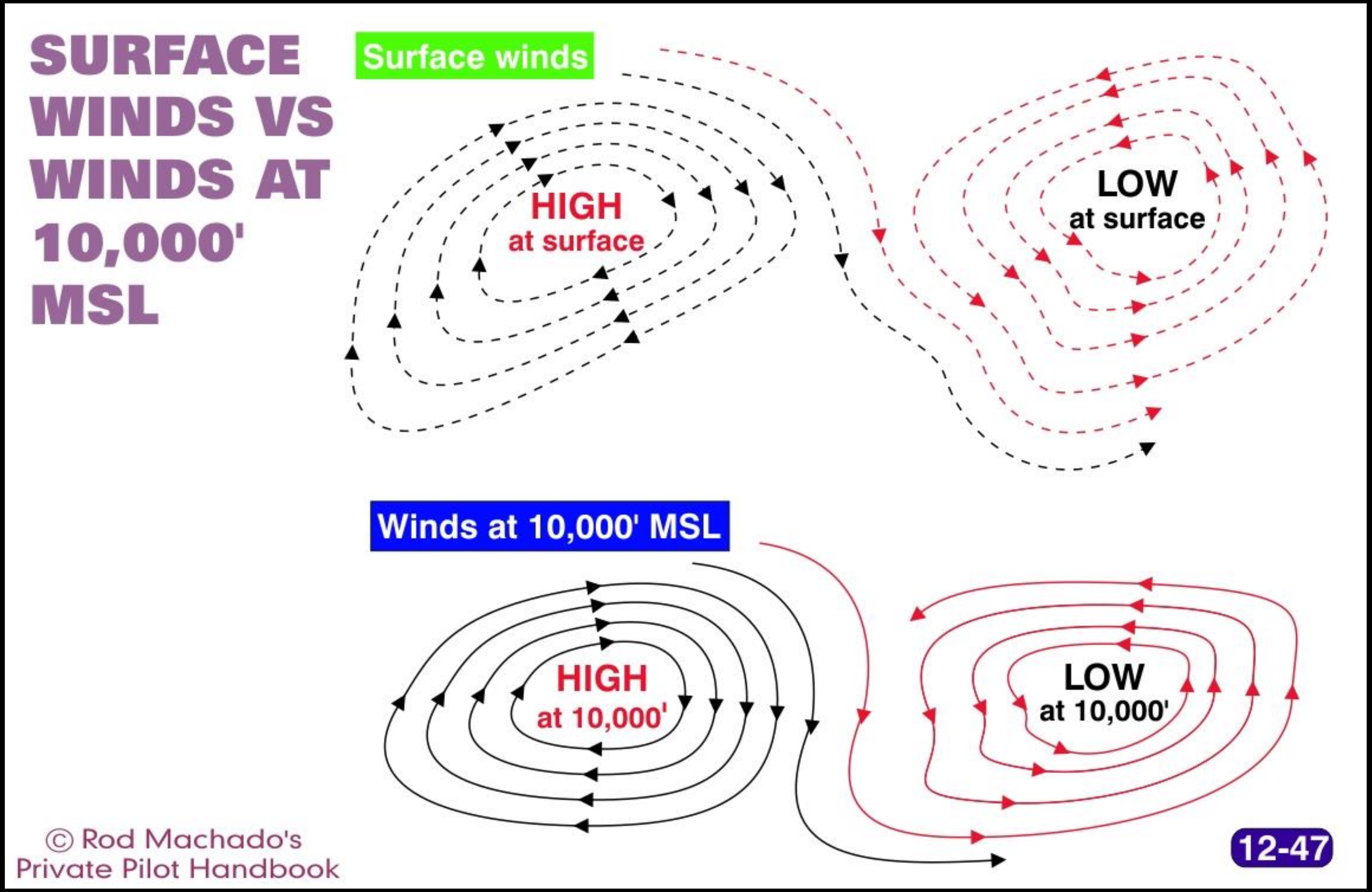
Surface Friction



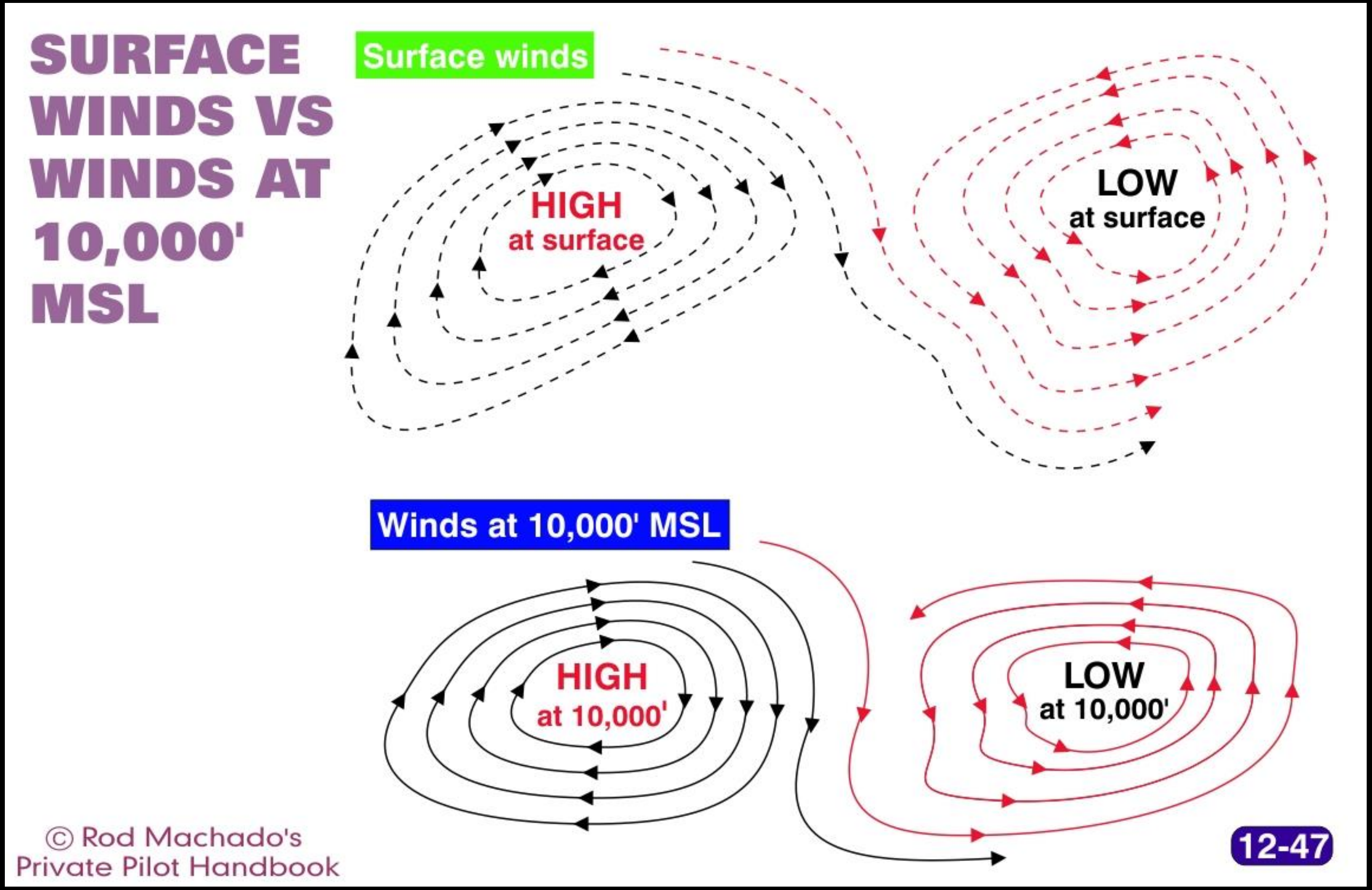
- The wind turns slightly left of the isobars within 2,000 feet of the surface
- Over water where there is less surface friction, wind curves left of the isobars by about 10 to 15 degrees
- Over land with greater friction, wind can curve 25 to 45 degrees left of the isobars

Surface Winds vs. Winds at 10,000 MSL

- Surface friction explains why weather maps depicting winds for high altitudes (more than 2,000 feet AGL) show isobars aligned differently from maps showing surface isobars



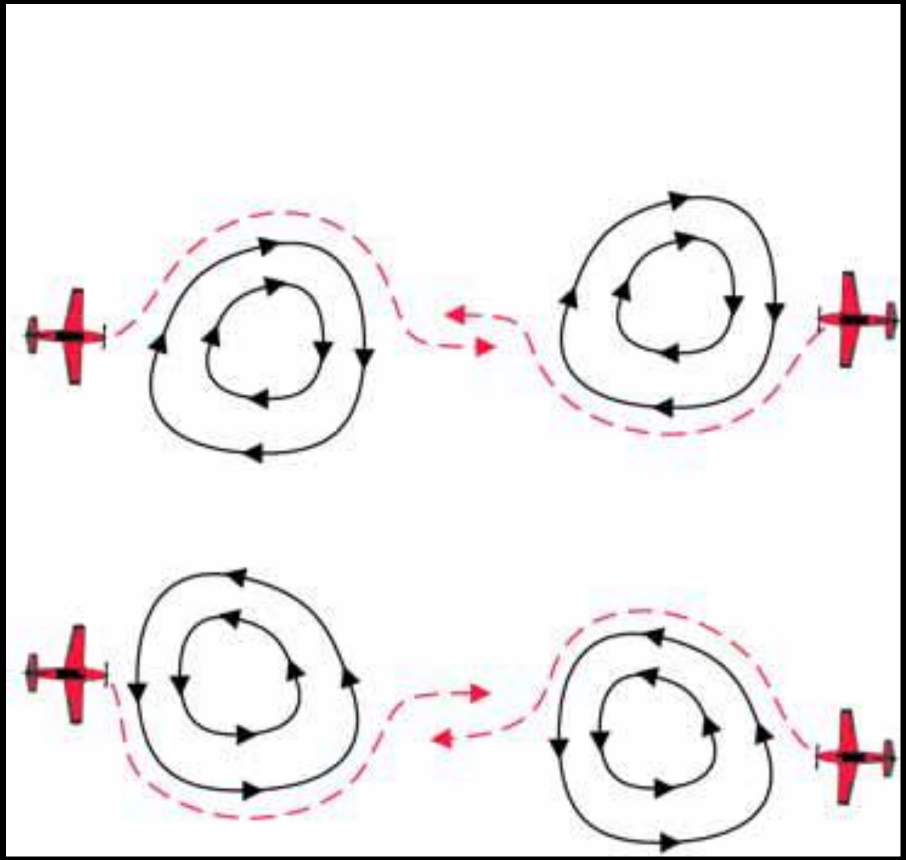
Surface Winds vs. Winds at 10,000 MSL



- Surface winds can give a false appearance of what the wind a few thousand feet above the surface is doing
- Windshear is common when surface winds are calm and the wind at higher altitudes (a few thousand or even a few hundred feet AGL) is moving quickly

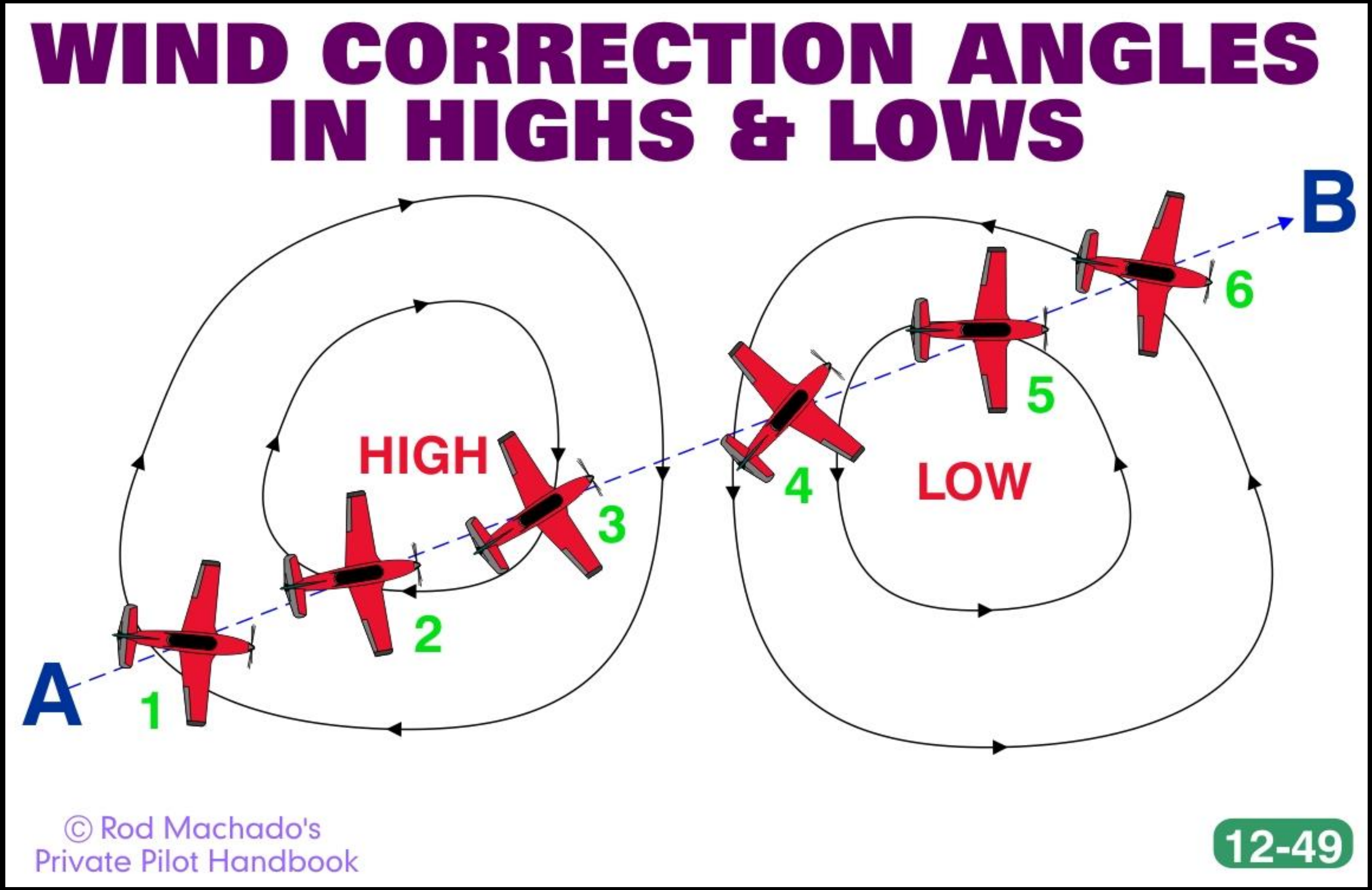
Pressure Pattern Flying

- Pilots on long cross-country flights take advantage of high-altitude airflow to gain a tailwind and avoid a headwind
- On west-to-east flights fly north of the high and south of the low
- On east-to-west flights fly south of the high and north of the low



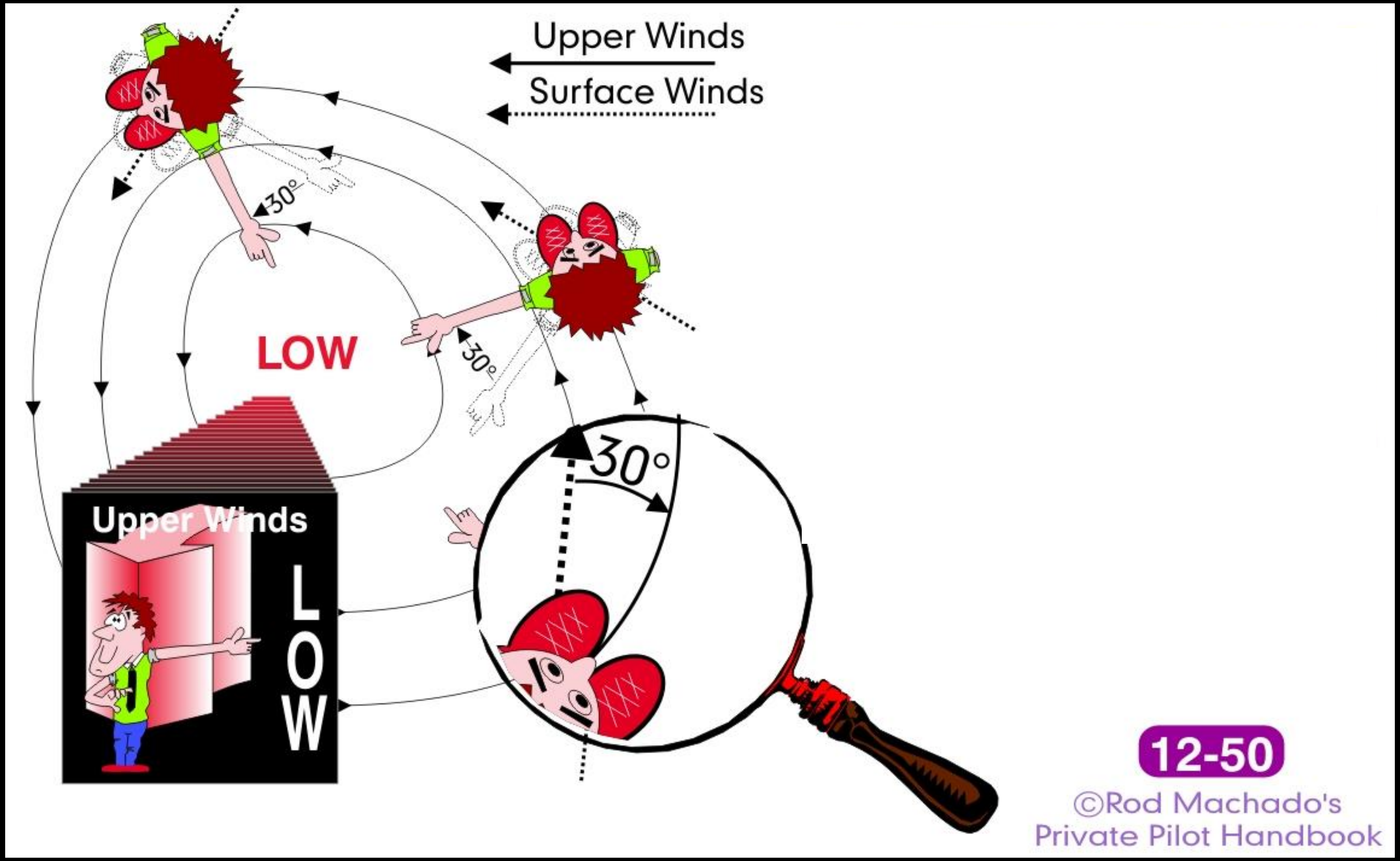
Wind Correction Angles

- Pilots can tell whether they're approaching a high or low based on the relationship between their wind correction angle and ground track
- You will always make a wind correction to the right when approaching a high, and to the left when approaching a low



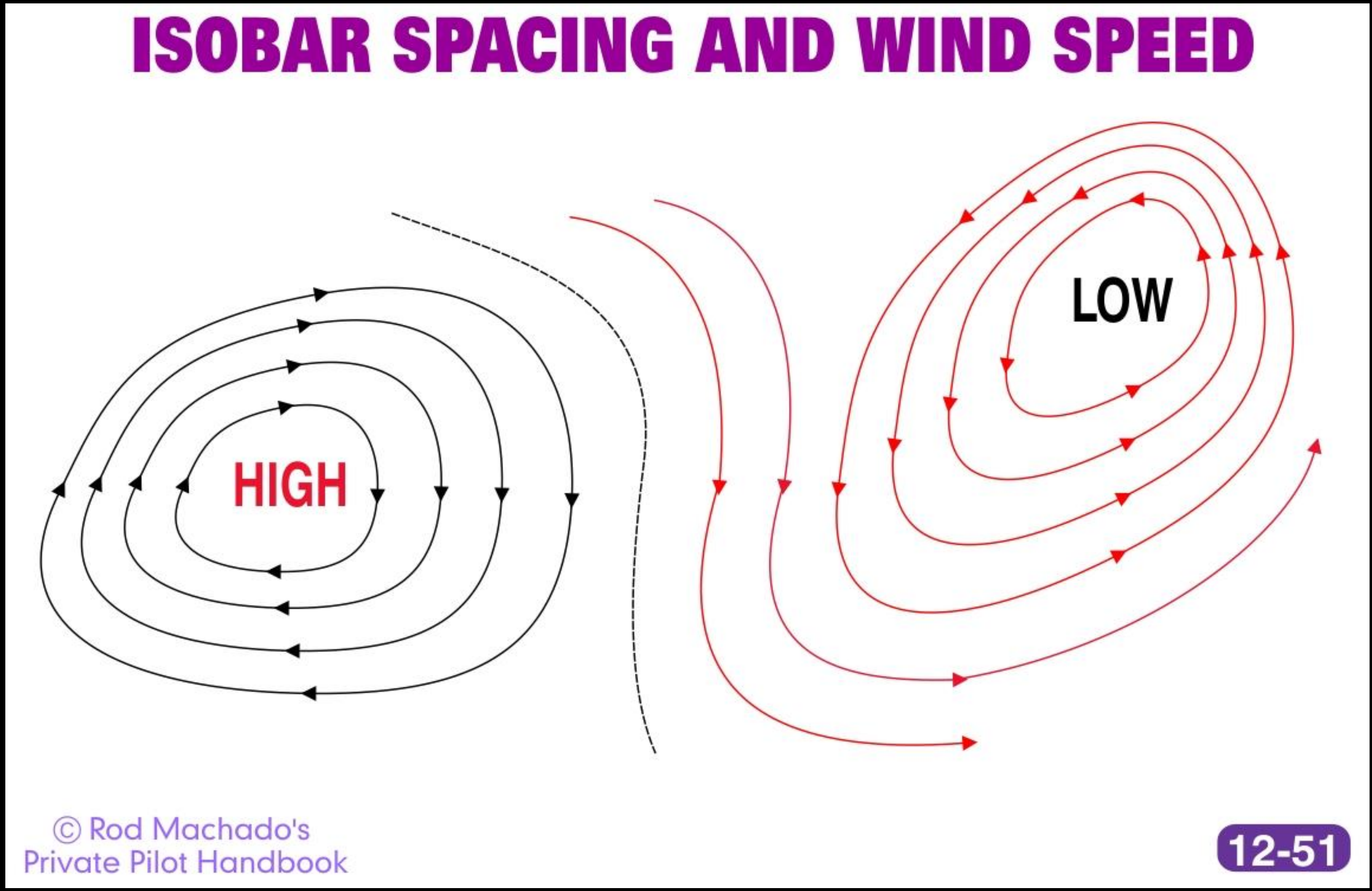
Determining the Location of a Low Pressure Area

- Stand with your back to the wind
- Rotate 30 degrees to the right (to compensate for the effects of ground friction)
- Your left hand will point in the direction of the low

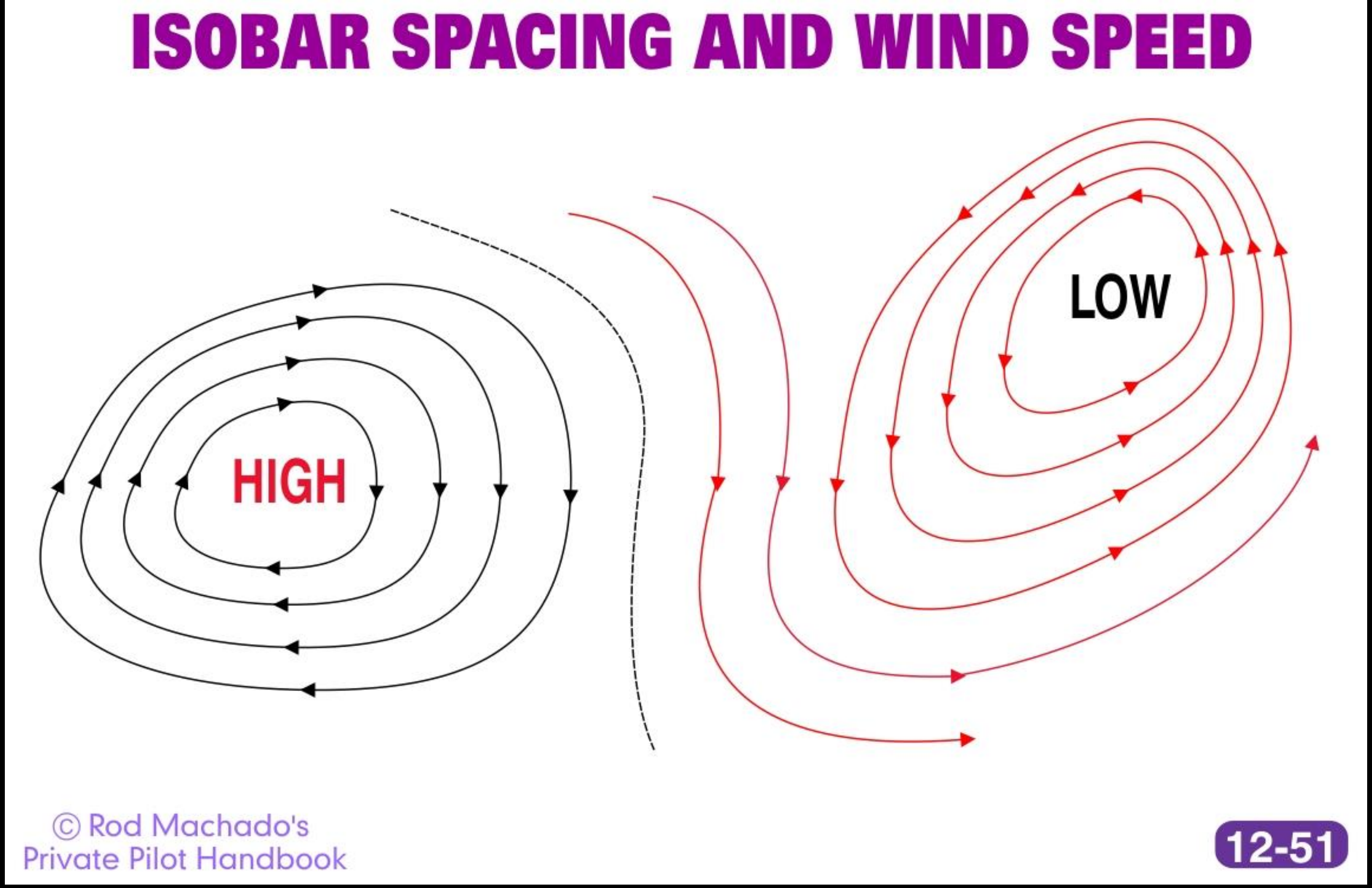


Isobar Spacing and Wind Speed

- Isobars are spaced closer around the low than the high
- Isobars are spaced at a pressure difference of 4 millibars on surface weather maps
- The closer the isobars are together, the more rapid the pressure change
- Rapid pressure changes mean faster winds



Isobar Spacing and Wind Speed



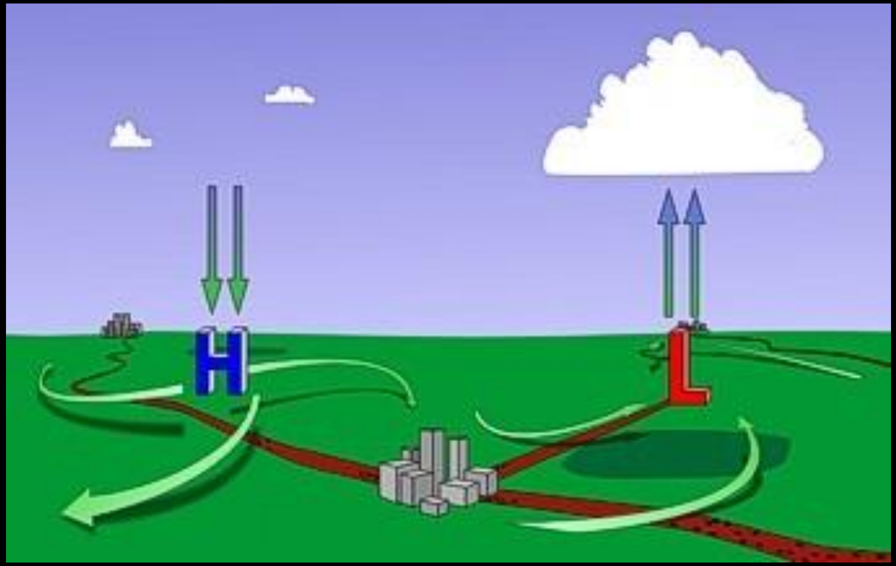
- Isobar comparison around the high and low provides a good indication of wind speed in that system
- Weak pressure gradients (areas where there isn't much horizontal pressure change) are depicted with dashed lines
- Expect light winds in this area

Weather Associated With Highs and Lows

- In addition to wind direction and speed, high and low pressure centers have their own weather associated with them

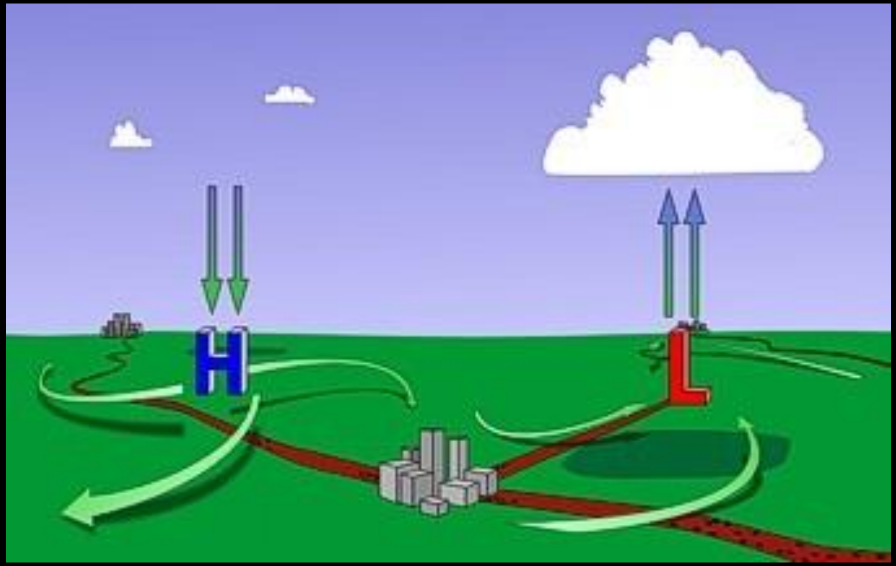
Divergence

- High pressure centers are cooler and denser masses of air
- As high pressure air descends it contacts the surface
- It spreads out in all directions away from the center of the high
- Coriolis force causes it to curve to the right causing a clockwise circulation



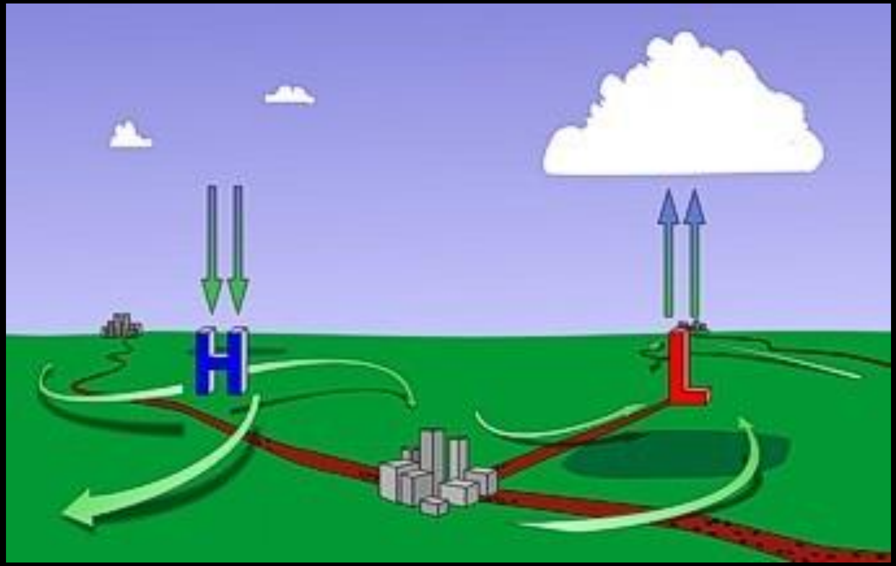
Divergence

- As high pressure air descends it warms due to compression, decreasing the relative humidity
- Clouds are less likely to form and clouds that are present are likely to dissipate
- Highs are generally associated with clear skies



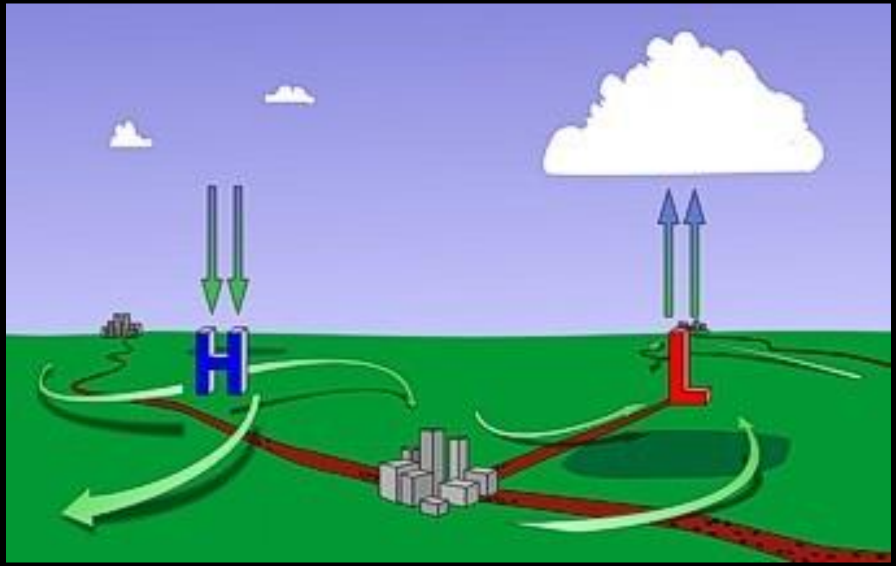
Convergence

- Low pressure centers are typically warmer, less dense masses of air
- Air converges near the center of a low from all directions and rises
- Convergence in the low accelerates the air and wind speed increases
- Wind velocities are generally higher around a low than a high



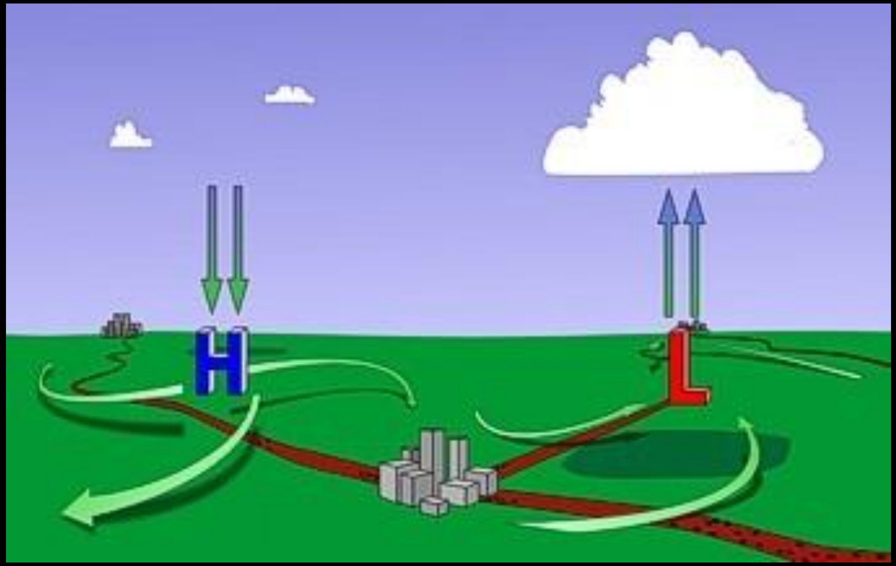
Convergence

- Lows have rising air that expands and cools
- If the air within the low approaches its dew point, condensation occurs
- Clouds appear and the weather usually gets worse



Convergence

- Air that condenses in a low pressure system releases its latent heat, adding to the heat content of the low pressure system
- The low pressure area is now slightly warmer, causing it to rise faster
- This further increases the chance that the weather in a low pressure area will continue deteriorating

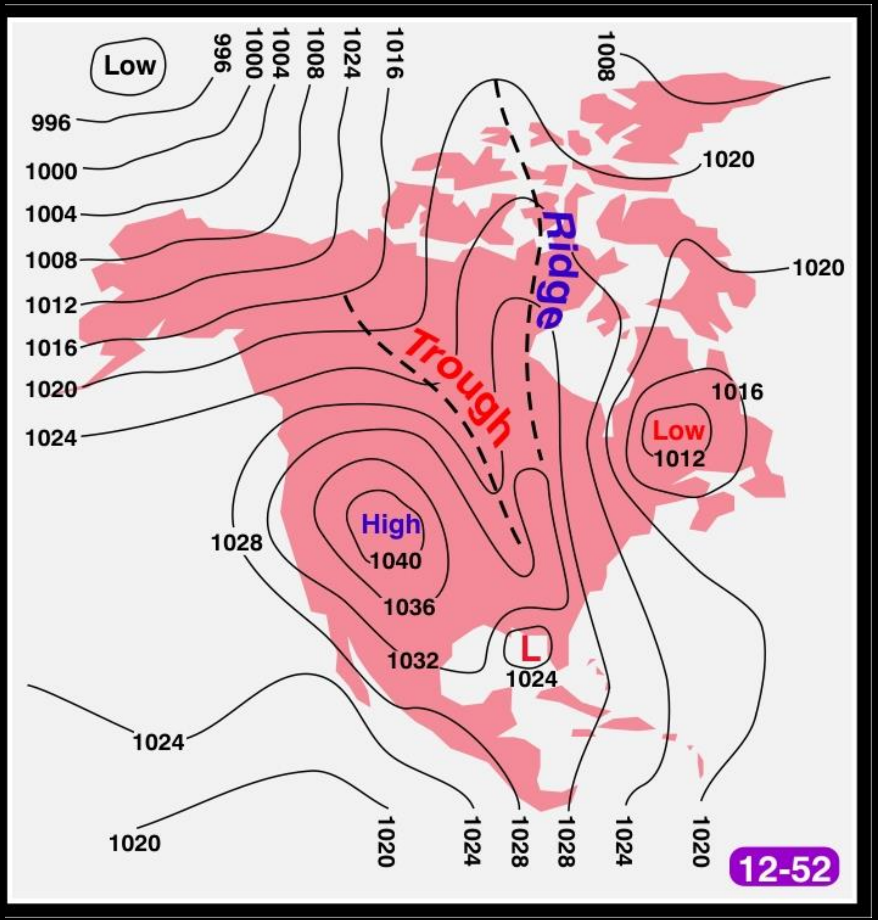


Convergence Divergence Summary

- **Divergence (High)**
  - Air moves downward, outward, and rotate in a clockwise direction
  - Winds diverge away from surface high pressure, causing the air to sink, compress, and warm, which favors the dissipation of clouds and precipitation
- **Convergence (Low)**
  - Air moves inward, upward, and rotates counterclockwise
  - Winds converge into surface low pressure, causing the air to rise, expand, and cool, which favors the formation of clouds and precipitation given sufficient moisture

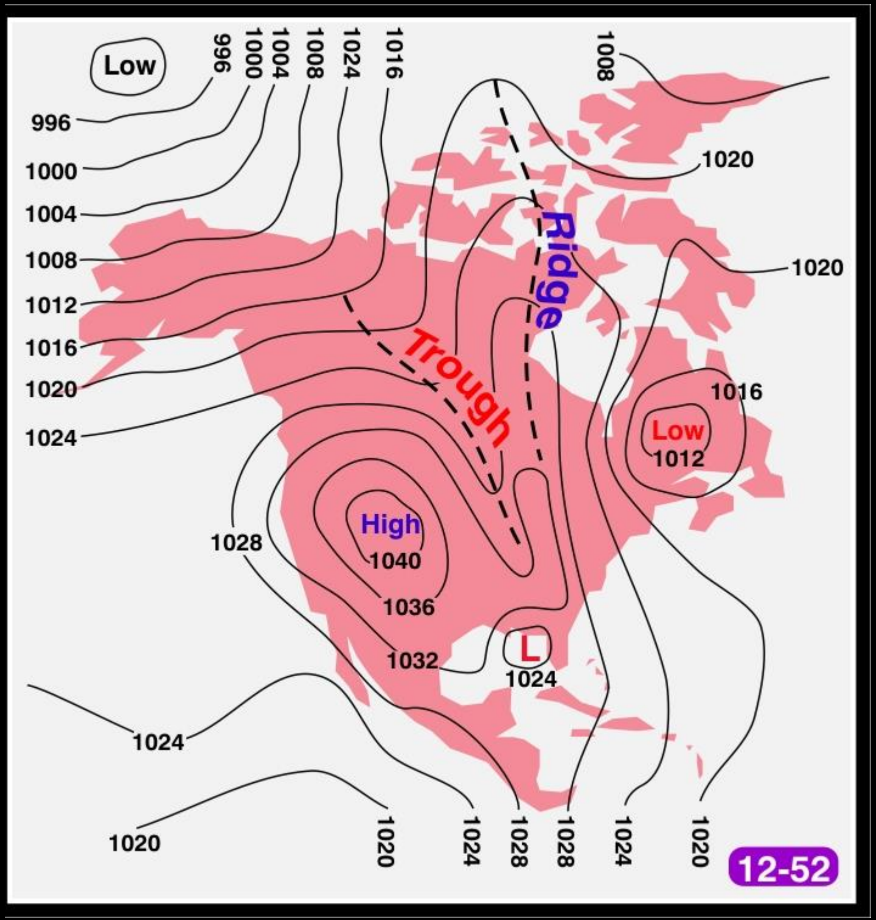
Troughs and Ridges

- Pressure patterns can take on elongated shapes
- A trough is an elongated area of low pressure
- The pressure along this line is lower than the pressure on either side



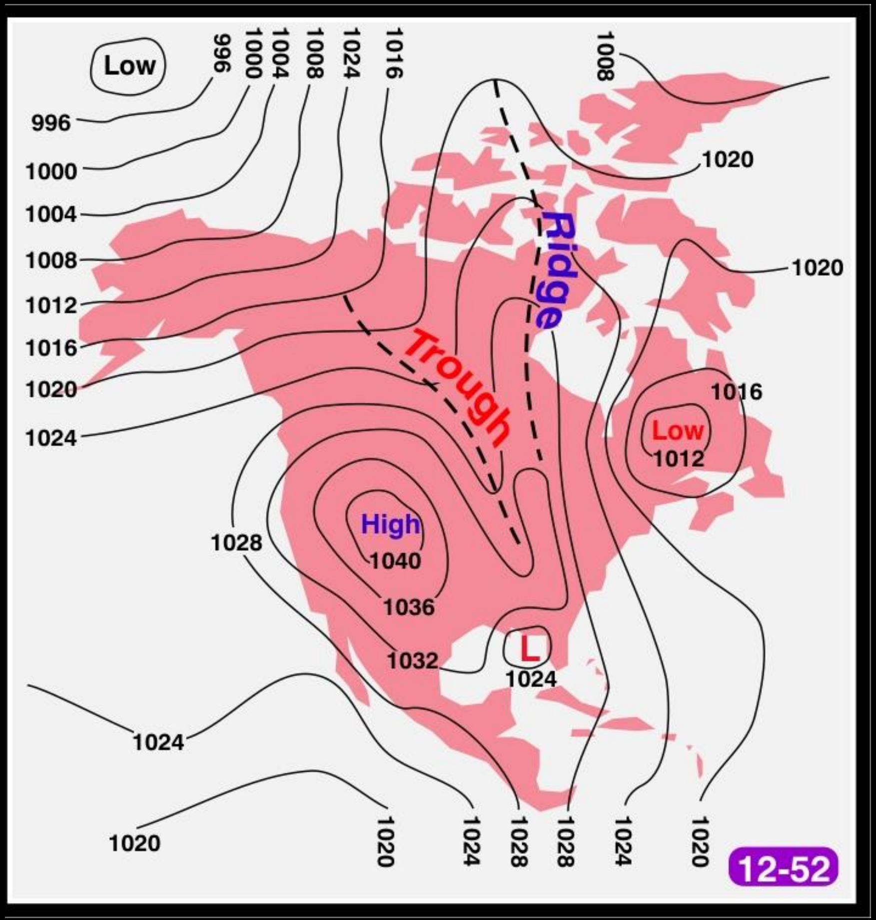
Troughs and Ridges

- Isobars show CCW circulation at the trough line but don't form a closed circulation pattern
- A trough frequently delineates the boundary between two different pressure centers
- Air flows toward the lower pressure and rises
- Storms gather at an atmospheric trough



Troughs and Ridges

- A ridge is an elongated area of high pressure
- The pressure is higher along the center of the ridge than it is on either side
- Similar to a mountain of piled up, heavy, descending air
- Exhibit characteristics similar to highs, with descending air and a minimum of cloudiness and precipitation



Clouds

- A cloud is a visible aggregate of minute water droplets and/or ice particles in the atmosphere above the Earth's surface
- Fog differs from cloud only in that the base of fog is at the Earth's surface while clouds are above the surface
- Clouds provide information on air motion, stability, and moisture, which help pilots visualize weather conditions and potential weather hazards

Clouds

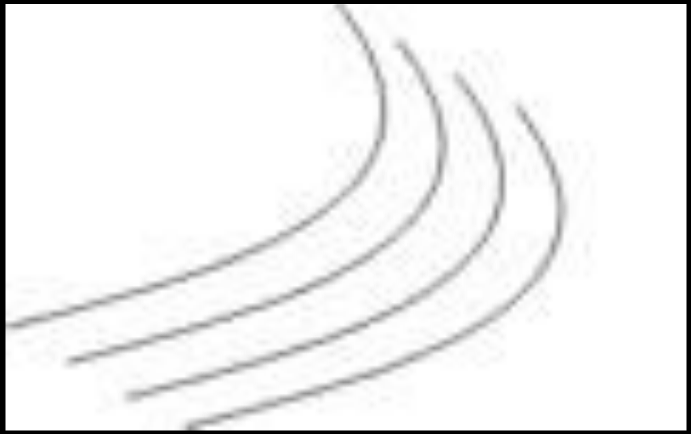
- Rising currents of air are necessary for the formation of vertically deep clouds capable of producing precipitation heavier than light intensity

Cloud Forms

- There are four basic cloud forms in the Earth's atmosphere:
  - Cirriform
  - Nimbus
  - Cumuliform
  - Stratiform

Cirriform

- High-level clouds that form above 20,000 feet and are usually composed of ice crystals
- High-level clouds are typically thin and white in appearance, but can create an array of colors when the sun is low on the horizon
- Cirrus generally occur in fair weather and point in the direction of air movement at their elevation



Nimbus

- *Nimbus* comes from the Latin word meaning *"rain"*
- Typically form between 7,000 and 15,000 feet and bring steady precipitation
- As the clouds thicken and precipitation begins to fall, the bases of the clouds tend to lower toward the ground

Cumuliform

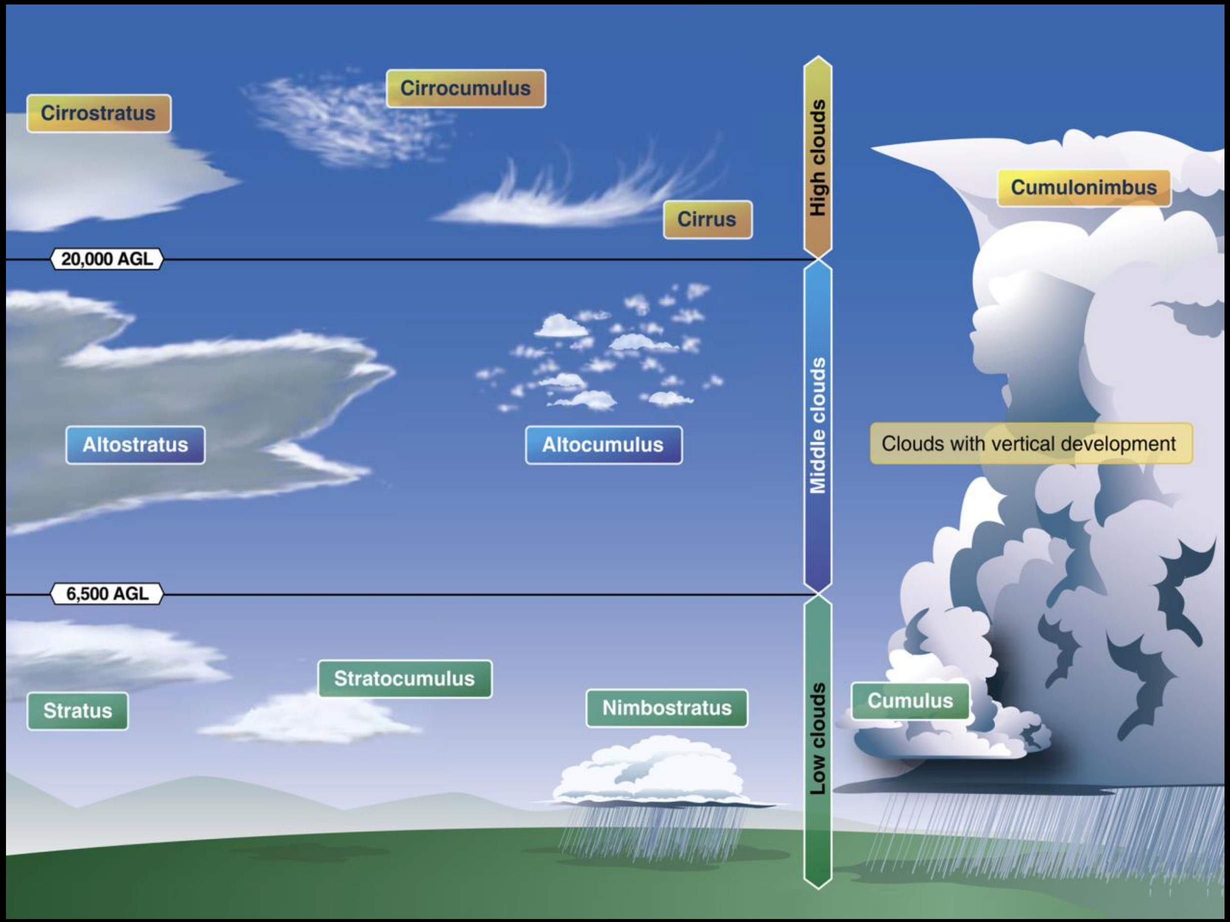
- Clouds that look like white, fluffy cotton balls or heaps and show the vertical motion or thermal uplift of air taking place in the atmosphere
- The level at which condensation and cloud formation begins is indicated by a flat cloud base, and its height depends on the humidity of the rising air
- The more humid the air, the lower the cloud base
- The tops of these clouds can reach over 60,000 feet

Stratiform

- Stratus is Latin for “layer” or “blanket”
- They consist of a featureless low layer that can cover the entire sky like a blanket, bringing generally gray and dull weather
- The cloud bases are usually only a few hundred feet above the ground
- Over hills and mountains, they can reach ground level when they may be called fog
- As fog lifts off the ground due to daytime heating, the fog forms a layer of low stratus clouds

Cloud Levels

- High clouds (over 20,000’)
- Middle clouds (6,500’ to 20,000’)
- Low clouds (surface to 6,500’)
- Those with extensive vertical development (+60,000’)



High Clouds

- Cirrus (Ci)
- Cirrocumulus (Cc)
- Cirrostratus (Cs)

- Typically thin and white in appearance, but can appear in a magnificent array of colors when the sun is low on the horizon
- Are composed almost entirely of ice crystals

Cirrus (Ci)

- Cirrus clouds in themselves have little effect on aircraft and contain no significant icing or turbulence

Cirrocumulus (Cc)

- May be composed of highly supercooled water droplets, as well as small ice crystals, or a mixture of both
- Pilots can expect some turbulence and icing.
- Note: Supercooled water droplets are below freezing. Even though their temperature is below the freezing point, they have not turned into ice

Cirrostratus (Cs)

- Cirrostratus clouds are composed primarily of ice crystals and contain little, if any, icing and no turbulence

Middle Clouds

- Altocumulus (Ac)
- Altostratus (As)
- Altocumulus Standing Lenticular (ACSL)
- Nimbostratus (Ns)

- Composed primarily of water droplets; however, they can also be composed of supercooled liquid water droplets and/or ice crystals when temperatures are below freezing

Altocumulus (Ac)

- Pilots flying through altocumulus can expect some turbulence and small amounts of icing

Altostratus (As)

- Pilots can expect little or no turbulence, but light to moderate icing in the supercooled water regions.

Altocumulus Standing Lenticular (ACSL)

- These formations are caused by wave motions in the atmosphere and are frequently seen in mountainous or hilly areas
- The cloud as a whole is usually stationary or slow moving
- Pilots can expect severe turbulence

Nimbostratus (Ns)

- Officially classified as a middle cloud although it may merge into very low stratus or stratocumulus. Other cloud classification systems may identify it as a low-level cloud
- Nimbostratus produces very little turbulence, but can pose a serious icing problem if temperatures are near or below freezing

Low Clouds

- Cumulus (Cu)
- Towering cumulus (TCu)
- Stratocumulus (Sc)
- Stratus (St)
- Cumulonimbus (Cb)

- Are low clouds composed of water droplets
- However, they can also be composed of supercooled liquid water droplets and/or ice crystals when temperatures are below freezing
- Cu and Cb usually have bases in the low level, but their vertical extent is often so great that their tops may reach into the middle and high levels

Cumulus (Cu)

- Fair weather cumulus
- For cumulus with little vertical development, pilots can expect some turbulence and no significant icing

Towering Cumulus (TCu)

- For towering cumulus (cumulus of moderate/strong development) pilots can expect very strong turbulence and some clear icing above the freezing level (where temperatures are negative)
- Towering cumulus is also referred to as the first stage of a thunderstorm

Stratocumulus (Sc)

- The highest liquid water contents are in the tops of these clouds where the icing threat is the greatest, if cold enough
- Pilots can expect some turbulence and possible icing at subfreezing temperatures

Stratus (St)

- Stratus produces little or no turbulence, but temperatures near or below freezing can create hazardous icing conditions
- When stratus is associated with fog or precipitation, the combination can become troublesome for visual flying

Stratus Fractus (StFra) and/or Cumulus Fractus (CuFra)

- Ragged shreds of low cloud always appear in association with other clouds for a short time before, during, and a short time after precipitation
- Often form beneath lowering altostratus (As) or nimbostratus (Ns)
- Also occur beneath cumulonimbus (Cb) and precipitating cumulus (Cu) and are collectively known as scud clouds

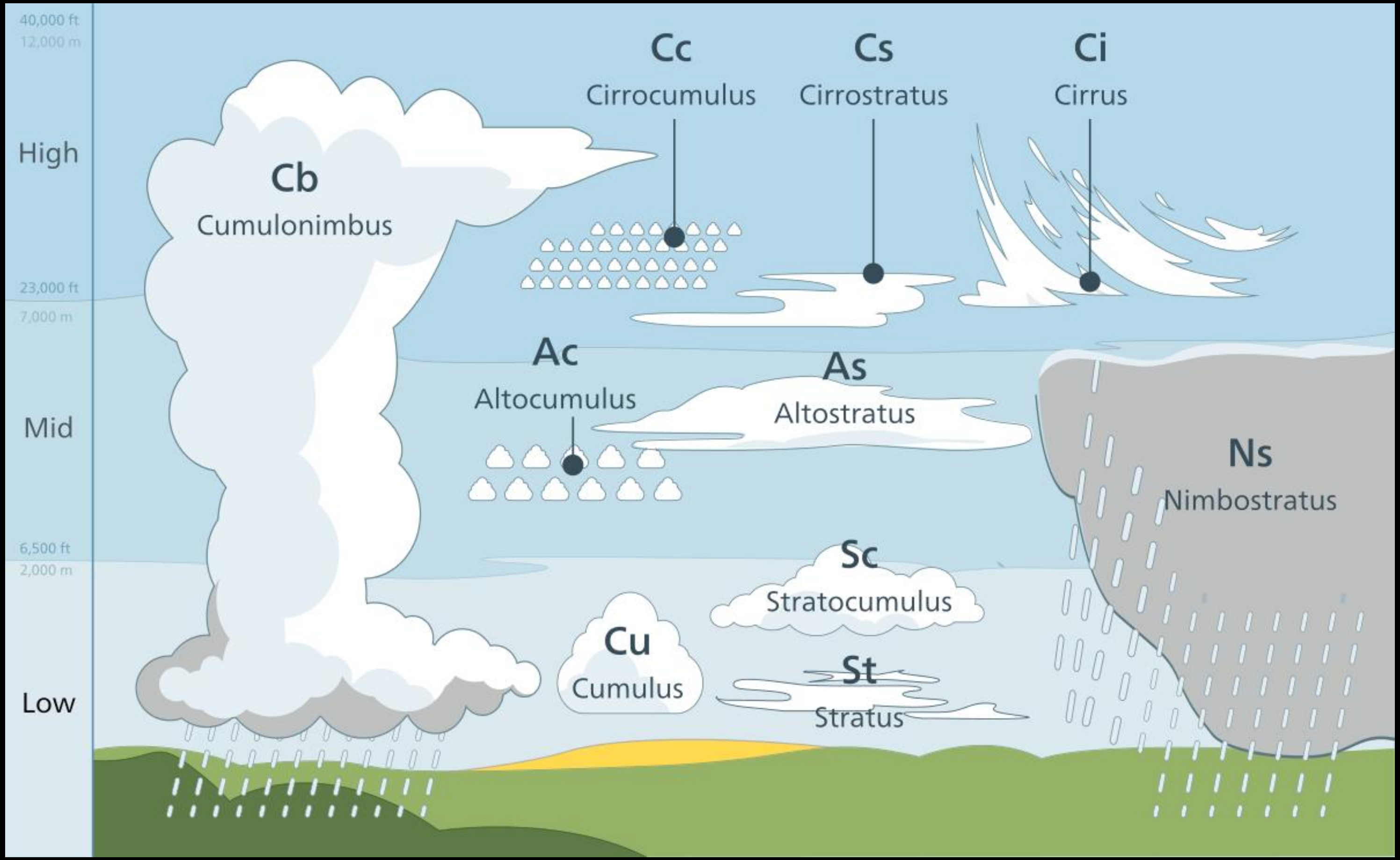
Cumulonimbus (Cb)

- Exceptionally dense and vertically developed, occurring either as isolated clouds or as a line or wall of clouds with separated upper portions
- Composed of water droplets and ice crystals, the latter almost entirely in its upper portions
- Also contains large water drops, snowflakes, snow pellets, and sometimes hail
- The liquid water forms may be substantially supercooled
- Cumulonimbus contains nearly the entire spectrum of flying hazards, including extreme turbulence

Cumulonimbus (Cb) With Anvil

- They may occur as an isolated cloud or an extensive wall and squalls, hail, and/or thunder often accompany them

Cloud Summary



Knowledge Check

All of the Earth's weather is due to

A. The planet's rotation
B. Uneven heating of the surface
C. Upper air circulation
D. Frontal movement

Knowledge Check

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A. ~~The planet's rotation~~
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Knowledge Check

Stability of an atmosphere is a measure of?

A. Cloud formation type
B. Atmospheric moisture content
C. Turbulence type
D. Temperature lapse rate

Knowledge Check

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A. ~~Cloud formation type~~
B. ~~Atmospheric moisture content~~
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D. Temperature lapse rate

Knowledge Check

The suffix “nimbus” in relation to clouds means what?

A. Rain
B. Vertical development
C. High-Level cloud
D. Thunderstorm

Knowledge Check

The suffix “nimbus” in relation to clouds means what?

A. Rain
B. ~~Vertical development~~
C. ~~High-Level cloud~~
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