

Assignment

On

“Thunderstorms”

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1. **Thunderstorm:**

A **thunderstorm**, also known as an **electrical storm**, **lightning storm**, or **thundershower**, is a [storm](https://en.wikipedia.org/wiki/Storm) characterized by the presence of [lightning](https://en.wikipedia.org/wiki/Lightning) and its [acoustic](https://en.wikipedia.org/wiki/Acoustics) effect on the [Earth's atmosphere](https://en.wikipedia.org/wiki/Earth%27s_atmosphere), known as [thunder](https://en.wikipedia.org/wiki/Thunder).[[1]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-1) Thunderstorms occur in a type of [cloud](https://en.wikipedia.org/wiki/Cloud) known as a [cumulonimbus](https://en.wikipedia.org/wiki/Cumulonimbus). They are usually accompanied by [strong winds](https://en.wikipedia.org/wiki/Wind), [heavy rain](https://en.wikipedia.org/wiki/Heavy_rain_(meteorology)), and sometimes [snow](https://en.wikipedia.org/wiki/Thundersnow), [sleet](https://en.wikipedia.org/wiki/Ice_pellets), [hail](https://en.wikipedia.org/wiki/Hail), or, in contrast, [no precipitation](https://en.wikipedia.org/wiki/Dry_thunderstorm) at all. Thunderstorms may [line up in a series](https://en.wikipedia.org/wiki/Thunderstorm_training) or become a rain band, known as a [squall line](https://en.wikipedia.org/wiki/Squall_line). Strong or [severe thunderstorms](https://en.wikipedia.org/wiki/Severe_thunderstorm) include some of the most dangerous weather phenomena, including large hail, strong winds, and [tornadoes](https://en.wikipedia.org/wiki/Tornado). Some of the most persistent severe thunderstorms, known as [supercells](https://en.wikipedia.org/wiki/Supercell), rotate as do cyclones. While most thunderstorms move with the mean wind flow through the layer of the [troposphere](https://en.wikipedia.org/wiki/Troposphere) that they occupy, vertical [wind shear](https://en.wikipedia.org/wiki/Wind_shear) sometimes causes a deviation in their course at a right angle to the wind shear direction.

1. **Thunderstorms Formation:**

On a hot summer day the surface of the Earth is heated by the sun. The Earth's surface heats the air just above the surface through the process of conduction.

The action of warm air rising and cold air sinking (convection) plays a key role in the formation of severe thunderstorms. If the warm surface air is forced to rise, it will continue to rise, because it is less dense than the surrounding air. In addition, it will transfer heat from the land surface to upper levels of the atmosphere through the process of convection.

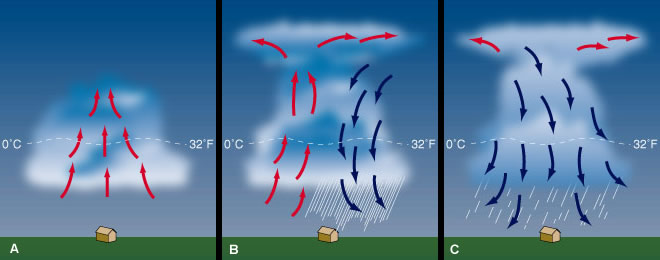
Two of the most important ingredients for thunderstorm formation are instability (unstable air) and moisture.

**Supercell thunderstorms**occur when very strong updrafts are balanced by downdrafts. This can allow the storm to persist for many hours. In a supercell, a moist, unstable body of warm air may be forced to rise by an approaching cold front.

The result is a strong, persistent updraft of warm moist air. Speeds in an updraft can be as fast as 90 miles per hour! The air cools as it rises. Water vapor condenses and forms cumulus clouds. When condensation occurs, heat (latent heat/energy) is released and helps the thunderstorm At some point, condensation high in the cloud (now in the form of water droplets and ice) falls to the ground as rain. A cold downdraft forms as the rain falls.

1. **Stages of Thunderstorm Formation:**

Most [thunderstorms](https://www.windows2universe.org/earth/Atmosphere/tstorm.html) form by a cycle that has three stages: the cumulus stage, mature stage, and dissipating stage.



**(A) Cumulus stage; (B) Mature stage; (C) Dissipating stage.**

* **Cumulus Stage:**  
  The [sun](https://www.windows2universe.org/sun/sun.html) heats the [Earth's surface](https://www.windows2universe.org/earth/Interior_Structure/surface.html) during the day. The [heat](https://www.windows2universe.org/earth/Atmosphere/temperature.html) on the surface and warms the air around it. Since warm air is lighter than cool air, it starts to rise (known as an updraft). If the air is moist, then the warm air condenses into a [cumulus](https://www.windows2universe.org/earth/Atmosphere/clouds/cumulus.html) cloud. The [cloud](https://www.windows2universe.org/earth/Atmosphere/cloud.html) will continue to grow as long as warm air below it continues to rise.
* **Mature Stage:**  
  When the cumulus cloud becomes very large, the [water](https://www.windows2universe.org/earth/water.html) in it becomes large and heavy. Raindrops start to fall through the cloud when the rising air can no longer hold them up. Meanwhile, cool dry air starts to enter the cloud. Because cool air is heavier than warm air, it starts to descend in the cloud (known as a downdraft). The downdraft pulls the heavy water downward, making [rain](https://www.windows2universe.org/earth/Atmosphere/precipitation/rain.html).

This cloud has become a [cumulonimbus](https://www.windows2universe.org/earth/Atmosphere/clouds/cumulonimbus.html) cloud because it has an updraft, a downdraft, and rain. [Thunder and lightning](https://www.windows2universe.org/earth/Atmosphere/tstorm/tstorm_lightning.html) start to occur, as well as heavy rain. The cumulonimbus is now a thunderstorm cell.

* **Dissipating Stage:**  
  After about 30 minutes, the [thunderstorm](https://www.windows2universe.org/earth/Atmosphere/tstorm.html) begins to dissipate. This occurs when the downdrafts in the cloud begins to dominate over the updraft. Since warm moist air can no longer rise, cloud droplets can no longer form. The storm dies out with light rain as the cloud disappears from bottom to top.

The whole process takes about one hour for an ordinary thunderstorm. [Supercell](https://www.windows2universe.org/earth/Atmosphere/tstorm/severe.html) thunderstorms are much larger, more powerful, and last for several hours.

1. **Classification of Thunderstorm:**

There are four main types of thunderstorms: single-cell, multi-cell, squall line (also called multi-cell line) and supercell. Which type forms depends on the instability and relative wind conditions at different layers of the atmosphere ("[wind shear](https://en.wikipedia.org/wiki/Wind_shear)"). Single-cell thunderstorms form in environments of low vertical wind shear and last only 20–30 minutes.

* **Single-cell:** This term technically applies to a single thunderstorm with one main updraft. Also known as [air-mass thunderstorms](https://en.wikipedia.org/wiki/Air-mass_thunderstorm), these are the typical summer thunderstorms in many temperate locales. They also occur in the cool unstable air that often follows the passage of a [cold front](https://en.wikipedia.org/wiki/Weather_fronts) from the sea during winter. Within a cluster of thunderstorms, the term "cell" refers to each separate principal updraft. Thunderstorm cells occasionally form in isolation, as the occurrence of one thunderstorm can develop an outflow boundary that sets up new thunderstorm development. Such storms are rarely severe and are a result of local atmospheric instability; hence the term "air mass thunderstorm". When such storms have a brief period of severe weather associated with them, it is known as a pulse severe storm. Pulse severe storms are poorly organized and occur randomly in time and space, making them difficult to forecast. Single-cell thunderstorms normally last 20–30 minutes.
* **Multicell lines:**

A squall line is an elongated line of [severe thunderstorms](https://en.wikipedia.org/wiki/Thunderstorms#Severe_thunderstorms) that can form along or ahead of a [cold front](https://en.wikipedia.org/wiki/Cold_front).[[19]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-19)[[20]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-20) In the early 20th century, the term was used as a synonym for [cold front](https://en.wikipedia.org/wiki/Cold_front).[[21]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-OU-21) The squall line contains

heavy [precipitation](https://en.wikipedia.org/wiki/Precipitation_(meteorology)), [hail](https://en.wikipedia.org/wiki/Hail), frequent [lightning](https://en.wikipedia.org/wiki/Lightning), strong straight line [winds](https://en.wikipedia.org/wiki/Wind),

and possibly [tornadoes](https://en.wikipedia.org/wiki/Tornado) and [waterspouts](https://en.wikipedia.org/wiki/Waterspouts).[[22]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-22) [Severe weather](https://en.wikipedia.org/wiki/Severe_weather) in the form of

strong straight-line winds can be expected in areas where the squall line

itself is in the shape of a [bow echo](https://en.wikipedia.org/wiki/Bow_echo), within the portion of the line that

bows out the most.[[23]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-23) [Tornadoes](https://en.wikipedia.org/wiki/Tornado) can be found along waves within a [line](https://en.wikipedia.org/wiki/Line_echo_wave_pattern" \o "Line echo wave pattern)

[echo wave pattern](https://en.wikipedia.org/wiki/Line_echo_wave_pattern" \o "Line echo wave pattern), or LEWP, where mesoscale [low pressure areas](https://en.wikipedia.org/wiki/Low_pressure_area) are

present.[[24]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-24) Some bow echoes in the summer are called [derechos](https://en.wikipedia.org/wiki/Derecho), and

move quite fast through large sections of territory.[[25]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-noaa-25) On the back edge of

the rain shield associated with mature squall lines, a [wake low](https://en.wikipedia.org/wiki/Wake_low) can form, which is a mesoscale low pressure area that forms behind the mesoscale high pressure system normally present under the rain canopy, which are sometimes associated with a [heat burst](https://en.wikipedia.org/wiki/Heat_burst).[[26]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-26) This kind of storm is also known as "Wind of the Stony Lake".

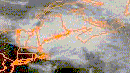
* **Supercells:**

Supercell storms are large, usually [severe](https://en.wikipedia.org/wiki/Severe_weather), quasi-steady-state storms that form in an environment where wind speed or wind direction varies with height ("[wind shear](https://en.wikipedia.org/wiki/Wind_shear)"), and they have separate downdrafts and updrafts (i.e., where its associated precipitation is not falling through the updraft) with a strong, rotating updraft (a "[mesocyclone](https://en.wikipedia.org/wiki/Mesocyclone)"). These storms normally have such powerful updrafts that the top of the supercell storm cloud (or anvil) can break through the [troposphere](https://en.wikipedia.org/wiki/Troposphere) and reach into the lower levels of the [stratosphere](https://en.wikipedia.org/wiki/Stratosphere), and supercell storms can be 24 kilometres (15 mi) wide. Research has shown that at least 90 percent of supercells cause [severe weather](https://en.wikipedia.org/wiki/Severe_weather).[[12]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-motion-12) These storms can produce destructive [tornadoes](https://en.wikipedia.org/wiki/Tornado), sometimes [F3](https://en.wikipedia.org/wiki/Fujita_scale) or higher, extremely large [hailstones](https://en.wikipedia.org/wiki/Hail) (10 centimeters or 4 inches diameter), [straight-line winds](https://en.wikipedia.org/wiki/Straight-line_wind) in excess of 130 km/h (81 mph), and [flash floods](https://en.wikipedia.org/wiki/Flash_flood). In fact, research has also shown that most tornadoes occur from this type of thunderstorm.[[28]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-28) Supercells are generally the strongest type of thunderstorm.

* **Severe thunderstorms:**

A thunderstorm is classed as severe if winds reach at least 93 kilometers per hour (58 mph), hail is 25 millimeters (1 in) in diameter or larger, or if [funnel clouds](https://en.wikipedia.org/wiki/Funnel_cloud) or [tornadoes](https://en.wikipedia.org/wiki/Tornado) are reported.[[29]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-29)[[30]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-30)[[31]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-31) Although a funnel cloud or tornado indicates a severe thunderstorm, a [tornado warning](https://en.wikipedia.org/wiki/Tornado_warning) is issued in place of a [severe thunderstorm warning](https://en.wikipedia.org/wiki/Severe_thunderstorm_warning). A severe thunderstorm warning is issued if a thunderstorm becomes severe, or will soon turn severe. In Canada, a rainfall rate greater than 50 millimeters (2 in) in one hour, or 75 millimeters (3 in) in three hours, is also used to indicate severe thunderstorms.[[32]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-32) Severe thunderstorms can occur from any type of storm cell. However, multicellular, [supercell](https://en.wikipedia.org/wiki/Supercell), and squall lines represent the most common forms of thunderstorms that produce severe weather

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* **Mesoscale convective systems:**

A [mesoscale convective system](https://en.wikipedia.org/wiki/Mesoscale_convective_system) (MCS) is a complex of thunderstorms that becomes organized on a scale larger than the individual thunderstorms but smaller than [extratropical cyclones](https://en.wikipedia.org/wiki/Extratropical_cyclone), and normally persists for several hours or more.[[33]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-33) A mesoscale convective system's overall cloud and precipitation pattern may be round or linear in shape, and include weather systems such as [tropical cyclones](https://en.wikipedia.org/wiki/Tropical_cyclone), [squall lines](https://en.wikipedia.org/wiki/Squall_line), [lake-effect snow](https://en.wikipedia.org/wiki/Lake-effect_snow) events, [polar lows](https://en.wikipedia.org/wiki/Polar_low), and [Mesoscale Convective Complexes](https://en.wikipedia.org/wiki/Mesoscale_Convective_Complex) (MCCs), and they generally form near [weather fronts](https://en.wikipedia.org/wiki/Weather_front). Most mesoscale convective systems develop overnight and continue their lifespan through the next day.[[8]](https://en.wikipedia.org/wiki/Thunderstorm#cite_note-Extreme_Weather-8) The type that forms during the warm season over land has been noted across [North America](https://en.wikipedia.org/wiki/North_America), [Europe](https://en.wikipedia.org/wiki/Europe), and [Asia](https://en.wikipedia.org/wiki/Asia), with a maximum in activity noted during the late afternoon and evening hours.

1. **Thunderstorm in Bangladesh:**

Bangladesh has seen a near-record number of deaths this year from a phenomenon that appears to be worsening with climate change: lightning strikes. The government said 70 people were killed after being hit by lightning in Bangladesh in last two months, with 33 of those happening on the last two days of April.

The problem has prompted Bangladesh's government to add lightning strikes to the country's list of official types of disasters, which includes floods, cyclones and storm surges, earthquakes, drought and riverbank erosion, among others.

1. **Tips to stay safe when Thunderstorm strikes:**

* **Before the storm:**
  + Unplug all non-essential appliances, including the television, as lightning can cause power surges.
  + Seek shelter if possible. When you hear thunder you're already within range of where the next ground flash may occur - lightning can strike as far as 10 miles away from the center of a storm.
* **During the storm:**
  + When indoors, avoid using your landline as telephone lines can conduct electricity. It's also best to avoid using taps and sinks with metal pipes as they can conduct electricity too.
  + If outdoors with no shelter, try to keep all metal and electrical objects about 20 metres away from you.
  + Avoid water and find a low-lying open place that is a safe distance from trees, poles or metal objects. Water will transmit strikes from further away and lightning likes to strike high objects.
  + Get inside a car if you can. Lightning will spread over the metal of the vehicle before earthing to the ground through the tyres.
  + If you find yourself in an exposed location squat close to the ground, with hands on knees and with head tucked between them. Try to touch as little of the ground with your body as possible, do not lie down on the ground.
  + Generally be aware of metal objects that can conduct or attract lightning, including golf clubs, umbrellas, motorbikes and bicycles, wire fencing and rails. If you're in a tent, try to stay away from the metal poles.
  + If you feel your hair stand on end, drop to the above position immediately.

1. **The Effects on Thunder & lightening on humans & nature:**

* **Struck by Lightning:**

Electrical currents from lightning strikes maintain a shorter duration than industrial shocks, averaging a few milliseconds per strike, but they can travel up to 10 miles horizontally. When a human gets exposed to a lightning strike, an external flashover occurs where the electrical current passes over the surface of the body. This can result in burns, mostly in the upper and lower body, specifically the head, shoulders and neck. Injury can also occur by making the victim fall or by throwing him through the air. Immediate death from a lightning strike is usually attributed to cardiac or cardiopulmonary arrest.

* **Lightning’s Effects in Nature:**

With a positive electrical charge, lightning travels between the negative base of a thunder cloud and the point of contact on Earth in about 30 seconds. Why specific objects attract lightning strikes is not yet fully understood by scientists, yet they know lightning tends to hit tall, free-standing structures, such as radio towers, telephones poles and trees, much more often than open ground. About 20 million lightning strikes hit the United States each year say scientists at Harvard University.

* **Sound Effects of Thunder**

Thunder occurs as an acoustical effect of high temperature and pressure during a lightning storm. The change in pressure affects the human ears, which is how thunder is heard. The highest pressure in a storm happens a few inches away from the origin of the lightning strike, causing a rumbling noise.

* **Thunder’s Mechanical Effects**

The pressure which results in thunder doesn't just have acoustical effects but mechanical ones as well. The high pressure of these lightning strikes can cause earthly damage, especially to metal objects. The pressure can be even more destructive when lightning strikes a small, closed area, such as a crack in a wall or a capillary in a tree. When pressure gets high enough and passes through tree capillary, the tree can explode.

1. **References:**
2. [**https://en.wikipedia.org/wiki/Thunderstorm**](https://en.wikipedia.org/wiki/Thunderstorm)
3. [**https://eo.ucar.edu/kids/dangerwx/tstorm4**](https://eo.ucar.edu/kids/dangerwx/tstorm4)
4. **https://www.telegraph.co.uk/news/0/stay-safe-thunder-lightning/**