"If you see a flash of lightning and you hear thunder 20 seconds later, how far away are you from the lightning in the thunderstorm? ____miles"1500 words

# A REPORT ON SUBJECT DISTANCE FROM A FLASH OF LIGHTNING IN A THUNDERSTORM WHEN 20 SECONDS LATER A THUNDER SOUND IS HEARD.

First you have to understand what lightning and thunder are. Lightning is the most spectacular element of a thunderstorm.

Lightning is an electric current and the result of tiny frozen raindrops collision. When the small pieces of ice bump into each other as they move around in the air, the collisions create an electric charge. Slowly, the whole cloud is full of positive and negative electric charges. The top of the cloud becomes positively charged with particles called protons, while the base of the cloud becomes negatively charged with particles called electrons. Since opposites attract, the negative charge at the bottom of the cloud wants to meet with the grounds positive charge.

Once the negative charge at the bottom of the cloud gets large enough, a flow of negative charge called a stepped leader rushes towards the earth. The positive charges at the ground are attracted to the stepped leader, so positive charge flows upward from the ground. When the two opposite charges meet, a strong electric current carries positive charge up into the cloud. This electric current is then seen as the bright flash of a lightning bolt. In the early stages of development, the air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground.

Whereas thunder is the sound created by lightning. Depending upon the distance from and the nature of the lightning, it can range from a long, low rumble to a sudden loud crack. The connection between lightning and thunder is made and the protons rush to meet up with the electrons. It's at this point that we see lightning and hear thunder.

Thunder and lightning actually happen at the same time, but since light travels faster than sound, you will see the light from lightning instantly ahead of the grumbling sound of thunder.

The roar of thunder is caused by the rapidly expanding atmosphere when a bolt of lightning heats the air along its path. The time between the lightning flash and thunder will tell you how far you are from the point where the lightning struck.

The sound of thunder serves as a warning to anybody outside as they are within the striking distance of the storm, hence are needed to get to a safe place immediately.

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To determine the distance between yourself and a lightning strike, you have to use a common method based on the time interval between the flash of lightning seen and the thunder heard to estimate the proximity of a thunderstorm. You can simply count the number of seconds between the flash and the sound of thunder and divide by 5 to get distance in miles.

The method relies on the fact that sound travels at a known speed through the air, and by measuring the delayed time between the flash of lightning and the thunder, you can estimate the distance from the lightning. This is the “flash to bang” method of calculating the distance.

The reason the method works is that light from lighting travels much faster through the air than thunder. Air slightly slows down light, but only about 56 miles per second. Lightning speed is still close to 186, 000mph, no matter where someone is on earth.

In the case above, if a lightning flash is seen and thunder heard 20seconds later, the distance from the lightning can be then calculated by understanding the sound speed and the principles of time and distance. Although a lightning discharge usually strikes just one spot on the ground, it travels many miles through the air.

When you listen keenly to the thunder, you will first hear the thunder created by that portion of lightning channel that is nearest you. Moreso, as you continue to listen, you will hear the sound created from the portions of the channel farther away. The speed of sound is affected more than the speed of lightning. The speed of sound is constant through air. Sound travels faster through warmer air than colder air, giving us the reason as to why sound travels more slowly at high altitudes.

Typically, a sharp crack will indicate that the lightning channel passed nearby. If thunder sounds more like a rumble, the lightning was at least several miles away. Thus, the loud boom that you sometimes hear is created by the main lightning channel as it reaches the ground.

To begin with, it's very crucial to understand and note that light travels much faster than sound, and the speed of light is approximately 299,792 kilometers per second which is equivalent to 186,282 miles per second, whereas the sound speed is much slower at around 343 meters per second, which is equivalent to 1,125 feet per second.

This significant difference in speed allows you to observe lightning flash almost instantaneously, as the sound takes a noticeable amount of time to reach your ears.

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When a flash of lightning occurs, heat rapidly surrounds the air causing it to expand explosively. The temperature of air in the lightning may reach as high as 50,000 degrees, which is 5 times hotter than the sun's surface. Immediately after the flash, the air cools and contracts. The expansion and contraction end up creating a sound wave that travels through the air thus resulting in the sound perceived by our ears as thunder. Through measuring the time span difference between the flash and thunder, you can do an estimate of distance to the lightning strike.

Moreso, to understand the calculation, it's important to consider that sound travels in waves. These waves move through the air by compressing and decompressing the air particles as they propagate. The sound speed is determined by the density and temperature of the air. To generalize, the speed of sound increases with temperature and decreases in air density.

To estimate the lightning strike distance, you have to convert the time difference between the flash and thunder into distance. As you know the sound speed, you can now multiply it by the delayed time in order to determine how far the sound has traveled during that interval.

Therefore, in this case, 20 seconds is the time delay, thus multiplying the value by the sound speed of 343 meters per second gives us the distance the sound has traveled during that time. Moreover, the distance will be in meters and as the question asks for the answer to be in miles, you have to convert the distance. But whichever number you use for the speed of sound, the flash of lightning reaches your eyes almost instantly, while the sound of thunder takes longer to reach your ears.

You can use the conversion factor of a mile equivalent to approximately 1609meters to convert the distance from meters to miles. Thus, by dividing the distance traveled by the speed of sound using the conversion factor, you can obtain the distance in miles.

Therefore, lets calculate the distance using the given delayed time of 20 seconds;

**Distance=Speed of sound × Time delay**

**343meters per second × 20 seconds**

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**=6,860 meters**

Now, let's convert the distance from meters to miles;

**Distance in miles=Distance in meters ÷ 1,609meters per mile**

**=6,860 meters ÷ 1,609 meters per mile**

**=4,27miles**

Therefore, if a flash of lightning is seen and thunder heard 20 seconds later, you are at an approximate distance of 4.27 miles away from the lightning strike. Thus, the National Weather Service recommends taking cover for at least 20 minutes. This is an indication that the lightning is less than 4 miles away and the next strike could potentially affect you.

It's nothing worth that the method provides an estimate rather than exact distance. The sound speed can vary depending on various factors such as humidity, atmospheric pressure and air temperature. The actual speed of sound may slightly deviate from the assumed value of 343 meters per second due to the highlighted factors above. Either way, the estimation method is generally accurate enough for practical purposes and allows individuals to assess the lightning strike distance in a thunderstorm.

## CONCLUSION

When you observe a lightning flash and hear thunder 20 seconds later, you may estimate that you are approximately 4.27 miles away from the lightning strike. The estimation is based on knowledge thar sound travels at a known speed through the air.

By measuring the time interval between the flash and thunder, you may calculate the distance using sound speed. Rather, as this method provides a reasonable estimate.

Other than understanding the lightning and thunder distance, you need to take proactive steps and measures in protecting your property from lightning strikes. Lightning protection systems are customized to protect buildings and a multitude of other industrial facilities from direct and indirect lightning strikes.  It's important to keep in mind that lightning strikes turn out dangerous and it's always important and best to seek shelter and adhere to proper safety protocols during

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and throughout the thunderstorm. Typically, lightning protection solutions are comprised of structural lightning protection, bonding and grounding and surge protection.

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