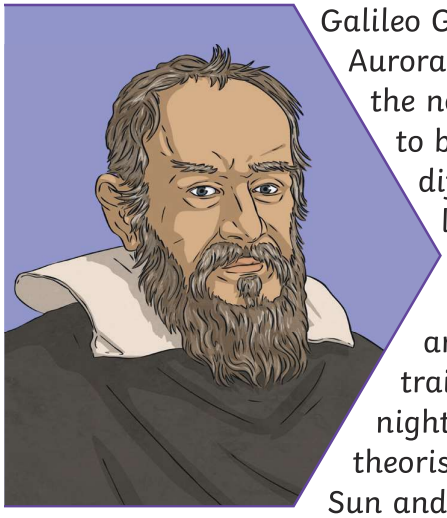
The Northern Lights

The Aurora Borealis, or Northern Lights, have been fascinating generations of people for thousands of years. These radiant and colourful waves of light, known as auroras and located in the 'auroral zone' above the Arctic Circle, are the result of racing, hot winds ejected from the Sun, meeting the Earth's atmosphere (the envelope of gases surrounding the Earth) far above the surface of our planet.

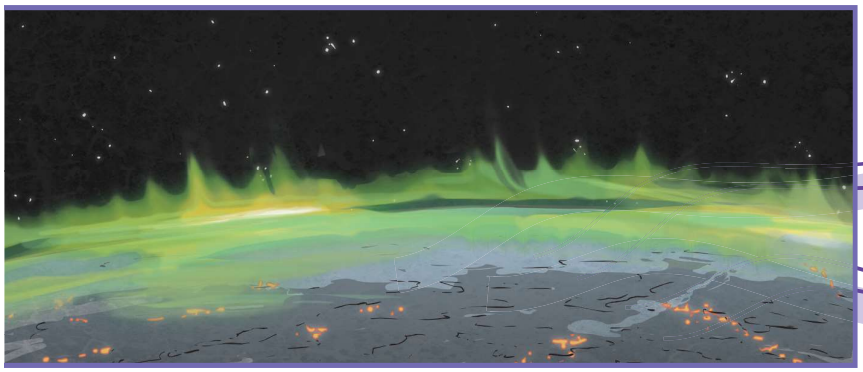
The Northern Lights in History



Galileo Galilei, the famous Italian astronomer, named them in 1619 after Aurora, the Roman goddess of the dawn, and Boreas, the Greek god of the north wind. A story from 2600 BC in China is considered by some to be the oldest recorded sighting of the lights. Throughout history, different cultures have had various ideas about what exactly the lights were and how they were formed. In Norse mythology, the luminous waves of colour were thought to be the result of sunlight reflecting off of the Valkyries' - warrior maidens who guarded ships and soldiers - armour. According to a legend from Finland, it was the trail left by a mythical creature called a firefox as he ran across the night sky. It wasn't until 1903 Kristian Birkeland, a Norwegian scientist, theorised that they were caused by the clash of charged particles from the Sun and the Earth's atmospheric gases.

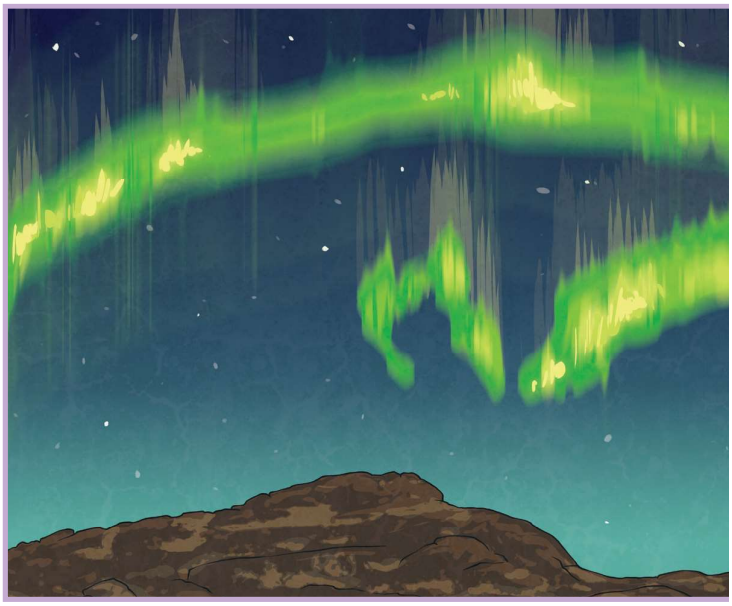
What Causes the Northern Lights?

Solar winds (a stream of charged particles released from the Sun) made up of protons and electrons (positively and negatively charged particles) are launched from the outermost layer of the Sun called the corona and then sent hurtling towards the Earth at speeds of up to 45 million mph. Our planet's magnetic field diverts these waves, sending them towards the north and south poles at altitudes of 60-155 miles. Here, they mingle with the gases that combine to create our atmosphere: predominantly oxygen and nitrogen. When mixed with charged particles, nitrogen gases tend to produce blue, purple and pink dancing waves of fluorescence. Oxygen, on the other hand, produces vibrant green, and sometimes red, ripples in the night sky.



The Northern Lights in Tourism

Extremely popular, the Aurora Borealis entices millions of tourists from all over the world to countries such as Norway, Sweden and Iceland. Due to the Earth's tilt away from the Sun in winter, December to March is considered the best time to see them: the nights are longer and the colder weather guarantees clearer skies. Many local businesses offer dog sled rides into the wilderness or cruises out into open waters, making it easier for visitors to witness this thrilling display without the distraction of city lights.



Other Auroras on Earth

The Aurora Borealis are not the only solar lights that we can see on Earth. In Tasmania, Australia, and Patagonia on the southernmost tip of South America, the Aurora Australis can be seen between March and September. They are caused by the same interaction of solar winds and atmospheric gases but occur at the South Pole instead. In lower latitudes, near the equator, mauve and green streaks and arcs seen in the night skies are known as STEVE (Strong Thermal Emission Velocity Enhancement).

Auroras in Space

Similar lights can be found on all planets within our solar system, especially the gas giants: Jupiter, Saturn, Neptune and Uranus. These large planets have the two basic elements: atmospheres of some kind and strong magnetic fields. Their powerful auroras can be seen across space through a telescope.

Auroras in Science

As frequently as they occur, scientists still do not understand everything about auroras. For example, we do not know why the Aurora Borealis and the Aurora Australis do not occur simultaneously. NASA is hoping to answer some of the many questions about the lights using their Parker Solar Probe, which was launched in 2018. This probe will orbit close enough to the Sun to examine the scorching corona, helping us to further understand the unique composition of solar winds.

Seeing the Northern Lights is a 'must do' for millions of people around the globe. Hopefully in the future, scientists will be able to explain more of the many mysteries behind this stunning phenomena. Until then, we can simply enjoy the incredible display as our ancestors did before us.

Questions

1. Which **two** gases make up the majority of the Earth's atmosphere? Tick one.
   - ○ oxygen and helium
   - ○ hydrogen and nitrogen
   - ○ oxygen and nitrogen
   - ○ hydrogen and helium

2. Fill in the missing words.

   Galileo Galilei, the famous Italian astronomer, named them in 1619 after

   _____, the Roman goddess of the dawn and _____, the

   Greek god of the north wind.

3. Number the events from 1-4 to show how the Northern Lights are formed.

   ☐ The Earth's magnetic field diverts the waves towards its poles.

   ☐ Oxygen and nitrogen gases mix with the particles in solar winds, causing multicoloured lights to appear in the atmosphere.

   ☐ Charged particles are launched from the Sun's corona towards Earth at high speed.

   ☐ Solar winds reach the Earth's surface.

4. Look at the section called **What Causes the Northern Lights?**
   Find and copy one word which shows that the solar winds are redirected towards the poles.

   _____

5. At what speed do solar winds travel towards the Earth?

   _____

6. Look at the section called **Auroras in Space**.
   Using what you know about auroras forming on Earth, explain how an aurora might happen on Jupiter.

   _____

   _____

   _____

7. Look at the section called **Other Auroras on Earth**.
   Compare the similarities and differences between STEVE and the Aurora Borealis.

8. Give an alternative name of your choice for the Northern Lights. Explain your answer.

9. Look at the section called **The Northern Lights in Tourism**.
   Explain why you think city lights might be a disadvantage when trying to see the Northern Lights.

10. Summarise what you have learnt about the Aurora Borealis using 25 words or fewer.

Answers

1. Which **two** gases make up the majority of the Earth's atmosphere? Tick one.
   ✓ **oxygen and nitrogen**

2. Fill in the missing words.
   Galileo Galilei, the famous Italian astronomer, named them in 1619 after **Aurora**, the Roman goddess of the dawn and **Boreas**, the Greek god of the north wind.

3. Number the events from 1-4 to show how the Northern Lights are formed.

   3 The Earth's magnetic field diverts the waves towards its poles.

   4 Oxygen and nitrogen gases mix with the particles in solar winds, causing multicoloured lights to appear in the atmosphere.

   1 Charged particles are launched from the Sun's corona towards Earth at high speed.

   2 Solar winds reach the Earth's surface.

4. Look at the section called **What Causes the Northern Lights?**
   Find and copy one word which shows that the solar winds are redirected towards the poles.
   diverts

5. At what speed do solar winds travel towards the Earth?
   Solar winds travel towards the Earth at 45 million mph.

6. Look at the section **Auroras in Space**.
   Using what you know about auroras forming on Earth, explain how an aurora might happen on Jupiter.
   Pupils' own responses, such as: I think that the solar winds reach Jupiter and then are diverted by the planet's magnetic field and mix with the atmosphere near the poles. This causes auroras to form just like they do on Earth.

7. Look at the section called **Other Auroras on Earth**.
   Compare the similarities and differences between STEVE and the Aurora Borealis.
   Pupils' own responses, such as: Aurora Borealis and STEVE both create coloured lights but Aurora Borealis occurs closer to the poles of the Earth while STEVE can occur in lower latitudes near the equator.

8. Give an alternative name of your choice for the Northern Lights. Explain your answer.
   Pupils' own responses, such as: I would call the Northern Lights STEVEN for Strong Thermal Emission Velocity Enhancement North because they are caused by the same thing as STEVE but happen in the north.

9. Look at the section called **The Northern Lights in Tourism**.
   Explain why you think city lights might be a disadvantage when trying to see the Northern Lights.
   Pupils' own responses, such as: I think the city lights would be a disadvantage because they can shine so bright and it's hard to see stars in the sky. I think the same thing would happen with the Northern Lights. It would be hard to see them with all the city lights shining upward into the sky.

10. Summarise what you have learnt about the Aurora Borealis using 25 words or fewer.
    Pupils' own responses, such as: The Aurora Borealis are caused by particles from the Sun hitting the Earth, mixing with gases and creating green and red lights in the sky.