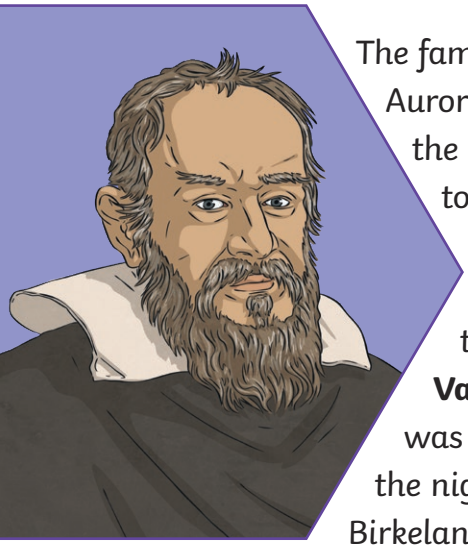
The Northern Lights

The Aurora Borealis, or northern lights, have been fascinating generations of people and cultures since ancient times. These colourful waves of light, known as auroras and located above the Arctic Circle in the North Pole, are caused by **solar winds** meeting the Earth's **atmosphere**. Extremely popular, the Aurora Borealis entices millions of tourists to countries such as Norway, Sweden and Iceland every year.

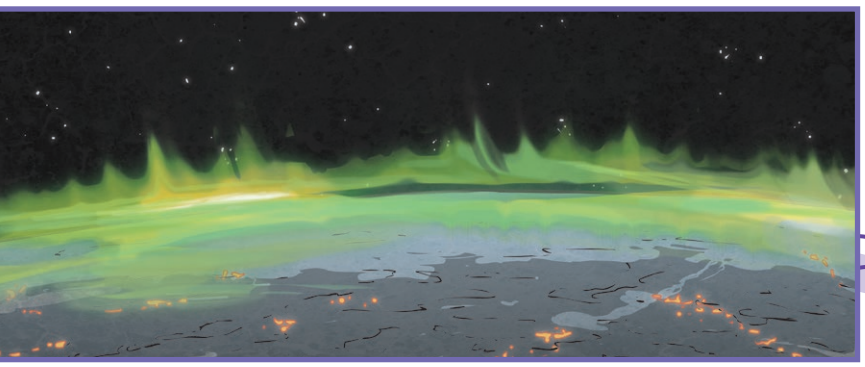
The Northern Lights in History



The famous Italian astronomer, Galileo Galilei, named them in 1619 - after Aurora, the Roman goddess of the morning, 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 northern lights were and how they were formed. In Norse mythology, the colourful waves were thought to be sunlight reflecting off of the **Valkyries**' shiny armour. According to an old 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 that the Norwegian scientist, Kristian Birkeland, worked out exactly what caused them.

What Causes the Northern Lights?

Solar winds are launched from the Sun's **corona** and then travel quickly towards the Earth at speeds of up to 45 million mph. Our planet's magnetic field redirects these waves, sending them towards the poles at **altitudes** of 60-155 miles, where they mingle with gases in the atmosphere: mostly nitrogen and oxygen. When mixed with charged particles, nitrogen gases tend to produce radiant blue, purple and pink waves of light. Oxygen, on the other hand, produces bright green, and sometimes red, ripples in the night sky.



Did You Know...?

Due to the Earth's tilt away from the Sun in winter, this season is considered to be the best time to see them.

Other Auroras

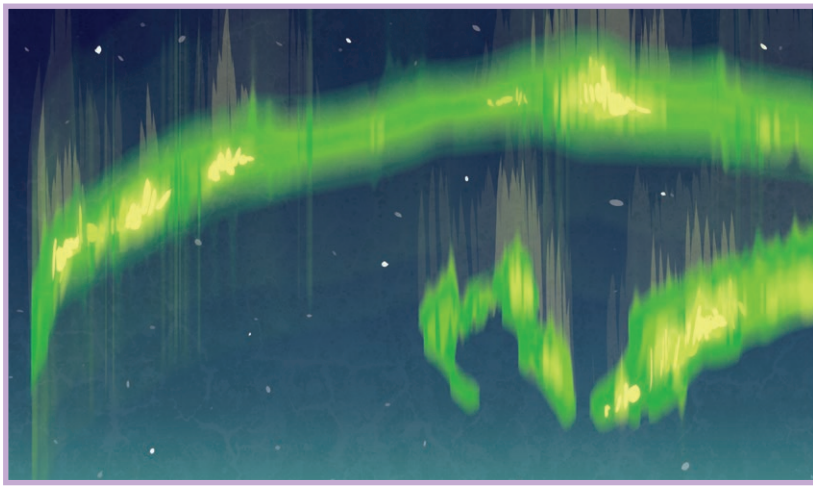
There are other auroras to be seen on Earth. Near the South Pole, the Aurora Australis can be seen between March and September. Nearer to the equator, mauve and green streaks and arcs found in the night skies are known as STEVE (Strong Thermal Emission Velocity Enhancement).

Did You Know...?

Similar lights can be seen on other planets, especially the gas giants: Jupiter, Saturn, Neptune and Uranus.

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 to the Sun to examine the corona, helping us to further understand solar winds.

Seeing the northern lights is a 'must do' for millions of people around the globe. In the future, scientists will be able to explain more about this stunning phenomena. Until then, we can simply enjoy the incredible display as our ancestors did before us.



Glossary

altitudes: How far above sea level an object is.

atmosphere: The envelope of gases surrounding the Earth.

corona: The outermost layer of the Sun.

solar winds: A stream of particles released from the Sun.

Valkyries: Warrior maidens in Norse mythology who guarded ships and soldiers.

Questions

1. What two mythical figures are the northern lights named after? Tick one.
   - ◯ Aurora and Boreas
   - ◯ Boreas and Valkyrie
   - ◯ Aurora and Firefox
   - ◯ Aurora and Valkyrie

2. What colour waves does nitrogen produce? Tick one.
   - ◯ mauve
   - ◯ blue, purple and pink
   - ◯ green
   - ◯ white

3. Fill in the missing words.
   It wasn't until 1903 that the Norwegian scientist, _____ ,
   worked out exactly what caused the northern lights.

4. Look at the section called **Other Auroras**.
   Find and copy one word that means 'to go around a planet or sun'.

   _____

5. At what altitudes do the northern lights appear?

   _____

6. Explain why winter is the best season to see the northern lights.

   _____

   _____

   _____

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

   _____

   _____

   _____

8. Look at the section called **What Causes the Northern Lights**?
   Explain in 25 words or fewer how auroras are made.

Answers

1. What two mythical figures are the northern lights named after? Tick one.
   ✓ **Aurora and Boreas**

2. What colour waves does nitrogen produce? Tick one.
   ✓ **blue, purple and pink**

3. Fill in the missing words.
   It wasn't until 1903 that the Norwegian scientist, **Kristian Birkeland**, worked out exactly what caused the northern lights.

4. Look at the section **Other Auroras**.
   Find and copy one word that means 'to go around a planet or sun'.
   orbit

5. At what altitudes do the northern lights appear?
   The northern lights appear at altitudes of 60-155 miles.

6. Explain why winter is the best season to see the northern lights.
   Pupils' own responses, such as: Winter is the best time to see the lights because the Earth is tilted away from the Sun so there is less daylight and the nights are longer, meaning there is more opportunity to see the lights.

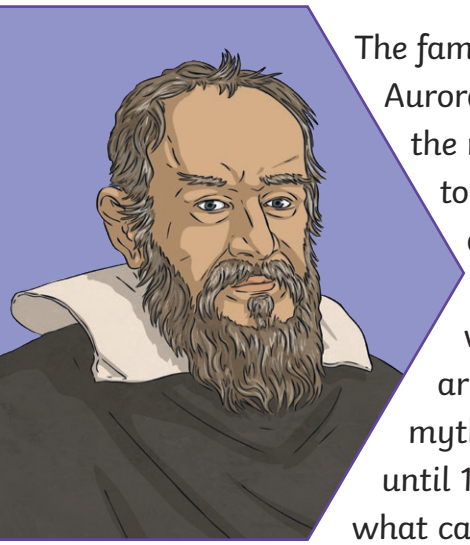
7. Look at the section called **Other Auroras.**
   Compare the differences and similarities between the Aurora Australis and the Aurora Borealis.
   Pupils' own responses, such as: They are both caused by the same thing - solar winds and the Earth's atmosphere mixing. They are different because Aurora Australis happens at the South Pole and Aurora Borealis happens at the North Pole.

8. Look at the section **What Causes the Northern Lights?**
   Explain in 25 words or fewer how auroras are made.
   Pupils' own responses, such as: Solar winds from the Sun hit the Earth's magnetic field. They are sent to the poles where they mix with the atmosphere to make lights.

The Northern Lights

The Aurora Borealis, or northern lights, have been fascinating generations of people for thousands of years. These colourful waves of light, known as auroras and located above the Arctic Circle in the North Pole, are the result of racing **solar winds** meeting the Earth's **atmosphere** far above the surface of our planet.

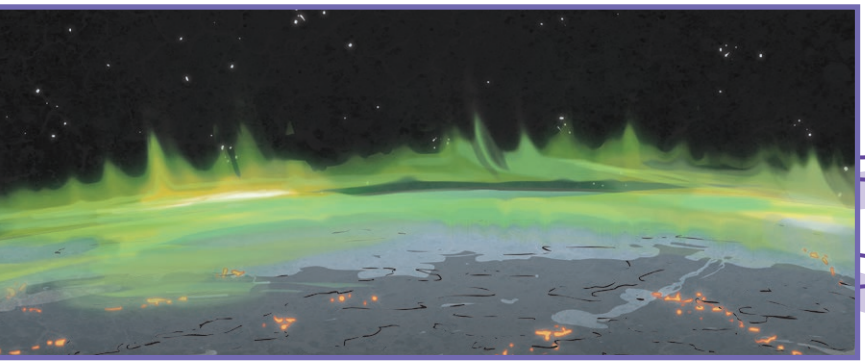
The Northern Lights in History



The famous Italian astronomer, Galileo Galilei, named them in 1619 after Aurora - the Roman goddess of the morning - 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 were thought to be sunlight reflecting off of the **Valkyries**' 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 that the Norwegian scientist, Kristian Birkeland, theorised exactly what caused the northern lights.

What Causes the Northern Lights?

Solar winds are launched from the Sun's **corona** and then travel towards the Earth at speeds of up to 45 million mph. Our planet's magnetic field diverts these waves, sending them towards the poles, at **altitudes** of 60-155 miles, where they mingle with the gases that create our atmosphere: primarily oxygen and nitrogen. When mixed with charged particles, nitrogen gases tend to produce blue, purple and pink waves of light. Oxygen, on the other hand, produces bright green, and sometimes red, ripples in the night sky.



The Northern Lights in Tourism

Extremely popular, the Aurora Borealis entices millions of tourists to countries such as Norway, Sweden and Iceland. Due to the Earth's tilt away from the Sun in winter, this season is considered to be the best time to see the lights: the nights are longer and the weather is colder, guaranteeing clearer skies.

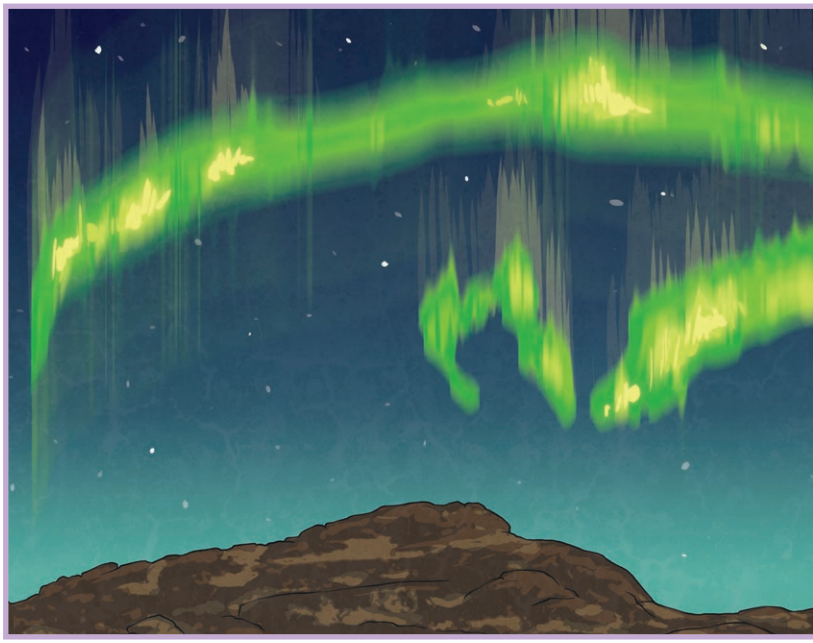
Other Auroras on Earth

The Aurora Borealis are not the only solar lights that we can see on Earth. In Tasmania, Australia and Patagonia (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 magnetic fields. Their auroras can be seen across space through a telescope.

Auroras in Science



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Valkyries: Warrior maidens in Norse mythology who guarded ships and soldiers.

As frequently as they occur, scientists still do not understand everything about auroras. 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 to the Sun to examine the corona, helping us to further understand 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 mysteries behind this phenomena. Until then, we can simply enjoy the incredible display as our ancestors did before us.

Questions

1. What is the name of the space probe heading towards the Sun? Tick one.
   - ○ Voyager
   - ○ Insight
   - ○ Parker
   - ○ Perseverance

2. When did Galileo name the lights Aurora Borealis? Tick one.
   - ○ 1903
   - ○ 1619
   - ○ 2018
   - ○ 1618

3. Look at the first paragraph of the text.
   Find and copy one word that tells you that solar winds move quickly.

   _____

4. Fill in the missing words.

   In Norse _____, the _____ waves were thought to be sunlight reflecting off of the Valkyries' armour.

5. When can the lights of the Aurora Australis be seen?

   _____

6. **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.**
   Explain why the firefox would leave a trail in the night sky.

   _____

   _____

   _____

7. Look at the section called **Other Auroras on Earth**.
   Explain why the best time to see Aurora Australis is different from the best time to see Aurora Borealis.

8. Explain in your own words why other planets in our solar system can also have auroras.

9. Look at the sections **The Northern Lights in History** and **The Northern Lights in Tourism**.
   Discuss why you agree or disagree with Galileo's name for the lights.

Answers

1. What is the name of the space probe heading towards the Sun? Tick one.
   ✓ **Parker**

2. When did Galileo name the lights Aurora Borealis? Tick one.
   ✓ **1619**

3. Look at the first paragraph of the text.
   Find and copy one word that tells you that solar winds move quickly.
   racing

4. Fill in the missing words.
   In Norse **mythology**, the **luminous** waves were thought to be sunlight reflecting off of the Valkyries' armour.

5. When can the lights of the Aurora Australis be seen?
   March to September

6. **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.**
   Explain why the firefox would leave a trail in the night sky.
   Pupils' own responses, such as: The firefox has fire in its name so it is either on fire or makes fire when it runs and that burns the sky.

7. Look at the section called **Other Auroras on Earth.**
   Explain why the best time to see Aurora Australis is different from the best time to see Aurora Borealis.
   Pupils' own responses, such as: It is different because March to September would be winter in the southern hemisphere. This is because of the Earth's tilt and how it travels around the Sun. Whereas, the northern lights can be seen in the other half of the year which is our winter.

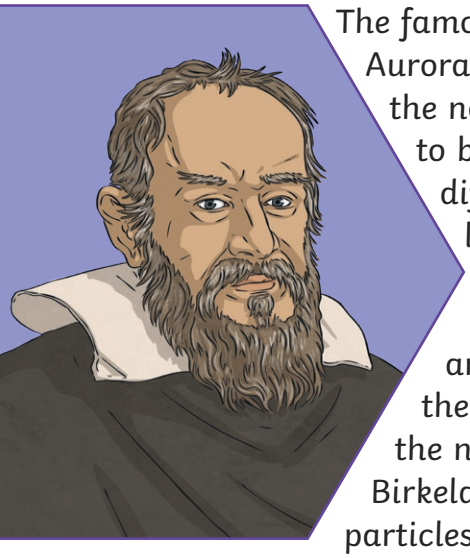
8. Explain in your own words why other planets in our solar system can also have auroras.
   Pupils' own responses, such as: Other planets in our solar system may have a magnetic field or an atmosphere, and they all encounter solar winds - the three things you need to make an aurora.

9. Look at the sections **The Northern Lights in History** and **The Northern Lights in Tourism.**
   Discuss why you agree or disagree with Galileo's name for the lights.
   Pupils' own responses, such as: I disagree with his name for the lights because he named them after the morning when actually the best time to see them is at night.

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.

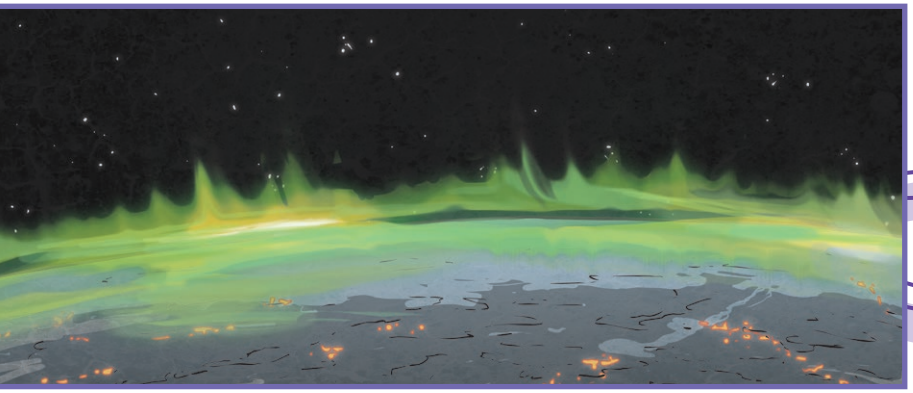
The Northern Lights in History



The famous Italian astronomer, Galileo Galilei, 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 that Norwegian scientist, Kristian Birkeland, theorised that they were caused by the clash of charged particles from the Sun and the Earth's atmospheric gases.

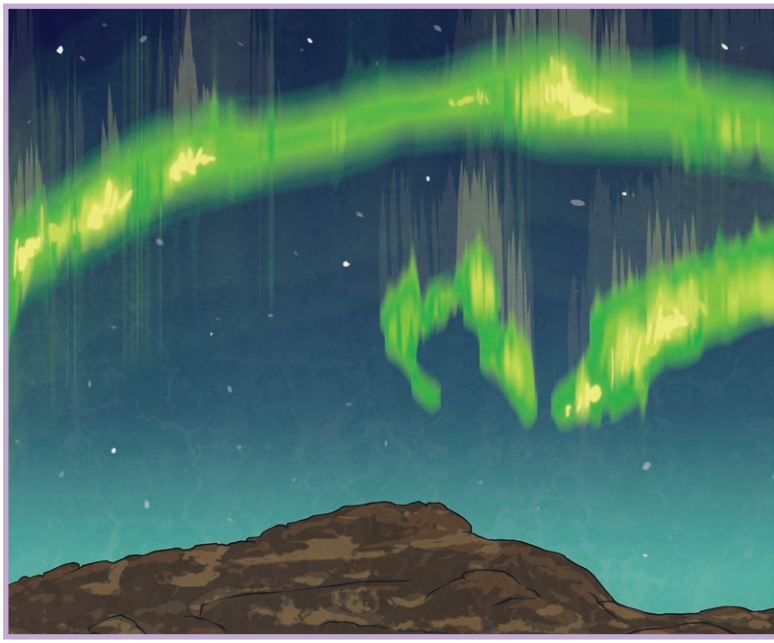
What Causes the Northern Lights?

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.

   The famous Italian astronomer, Galileo Galilei, 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.
   The famous Italian astronomer, Galileo Galilei, 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?
   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, 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.