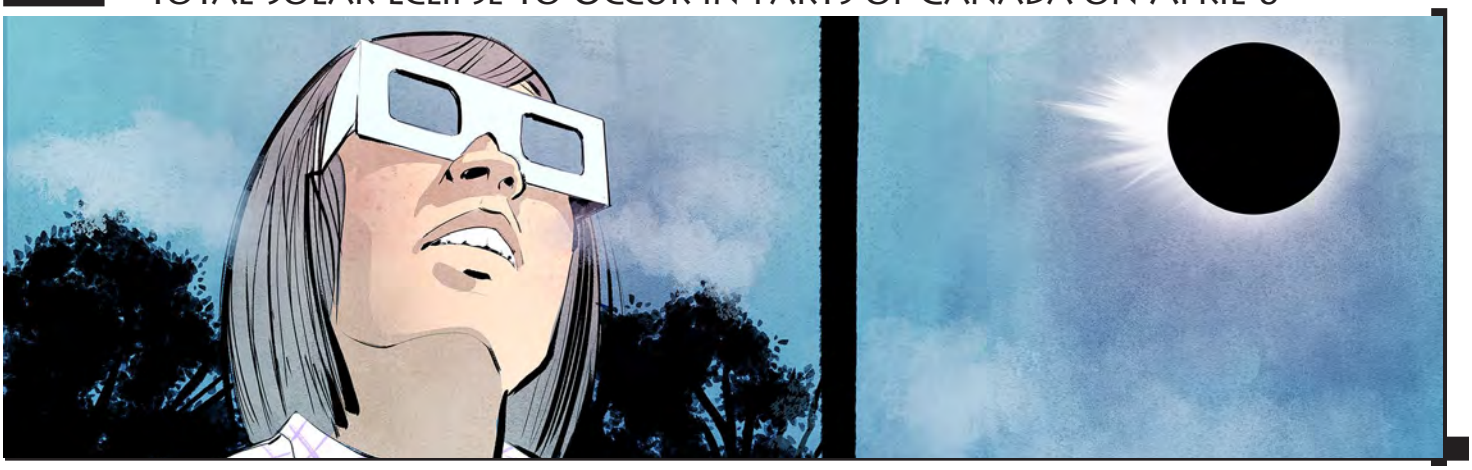
Science, Technology, and the Environment

THE DISAPPEARING SUN

– Total Solar Eclipse to Occur in Parts of Canada on April 8



If April 8 is a clear day, many Canadians will watch the Sun vanish. The reason? The Moon will line up perfectly between the Earth and the Sun. This will block the Sun and cast a shadow on parts of Earth. Such an event is called a total solar eclipse.

A Place-Specific Event

An eclipse is place-specific. It is only visible along the path where the Moon blocks the Sun. The path where a solar eclipse is complete is called the "path of totality."

Imagine holding a dinner plate between you and a lamp. Line things up so that it looks like the lamp and plate are about the same size. If you're directly behind the plate, the lamp will not be visible. Your friend standing beside you may see part of the lamp past the edge of the plate. Someone a few steps away will see the lamp normally. The plate will not affect their view.

For places far from the path of totality, there will be no sign of the eclipse. Places outside the path but near it will see a partial eclipse that dims the sky like twilight. A total eclipse brings near-complete darkness along the path.

Imagine how scary a total solar eclipse seemed to people long ago. To the ancient Greeks, who believed the gods were angry, it **heralded** disaster. The word eclipse comes from the Greek word "ekleipsis." That translates to "being abandoned."

A Rare Total Eclipse

The diameter of the Sun is about 400 times that of the Moon. How can something so much smaller block the Sun? Because the Sun is about 400 times farther away from the Earth than the Moon is.

If the Moon was only 273 kilometres smaller in diameter, a total eclipse would not be possible. The same is true if it were any farther from Earth. As it is, the Moon's orbit around Earth is **elliptical**. When an eclipse happens with the Moon at the far point of its orbit, it can't block the Sun completely. Instead, a halo of light appears around the Moon. This is called an annular eclipse.

In the far future, total eclipses may no longer occur because the Moon is slipping away from the Earth by a tiny amount (about 3.8 centimetres) each year.

A solar eclipse can happen only during a new moon phase when the Moon is between Earth and the Sun. At such times the Moon appears dark to us.

Why don't we get an eclipse with every new moon? If the orbit of the Moon around Earth were on exactly the same plane as the orbit of Earth around the Sun, we would. But the orbit of the Moon tilts about five degrees

DEFINITIONS

ELLIPTICAL: shaped like an oval

HERALD: to be a sign that (something) is about to happen

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relative to Earth's orbit around the Sun. Usually, when the Moon passes in front of the Sun, the Moon's shadow reaches into space and doesn't fall on Earth.

A PATH OF DARKNESS

The April 8 solar eclipse will create a line of darkness through parts of Mexico, the United States, and Canada. There won't be another total solar eclipse in North America until 2044.

In Canada, the path of totality will travel through the eastern provinces. Some Ontario cities to be plunged into shadow include Port Dover, Niagara Falls, Hamilton, Belleville, Kingston, and Cornwall. In Québec, Sherbrooke, Saint-Georges, and parts of southern Montréal will experience the full eclipse. So will residents of Fredericton, Miramichi, and the northern tip of Cape Breton Island.

Cities closest to the centre of the path of totality will have the longest eclipses. The total eclipse may last just a few seconds or as long as three and a half minutes.

NASA calculates that the eclipse will peak in Canada along the north shore of Lake Erie just before 3:15 pm. Minutes later, it will darken cities along Lake Ontario. It will reach residents of central New Brunswick and western Prince Edward Island after 4:30 their time. Canada's final glimpse of it will be at 5:10 local time in Newfoundland,

STAYING SAFE

As amazing as the eclipse will be, it's not safe to look at it without protection. The infrared radiation can cause permanent eye damage. Sunglasses aren't enough. Looking through dark material such as a garbage bag won't cut it, either. The same goes for using binoculars or a telescope that don't have a solar filter. You need to wear special eclipse glasses to view an eclipse.

If you don't have eclipse glasses, you can build a pinhole camera to observe the shadow cast by the Moon in miniature.

You can also experience the eclipse with your ears! One free app, Soundscapes, includes an interactive "Rumble Map." It transforms the eclipse into a touch- and sound-based experience. Another option is to build a LightSound Device, developed at Harvard University. It outputs sound based on detected brightness. As the Moon blocks the Sun, the sound levels decrease.

The tools were developed for the Blind and Low Vision community, but anyone can use them to safely enhance the eclipse experience.

A BIG OPPORTUNITY

Total solar eclipses occur about every 400 years or so. The last time Kingston, Ontario, was in the path of totality was nearly 700 years ago, in 1349. The next time will be 375 years from now, in 2399. So cities in the path of totality can expect many visitors on April 8. As the eclipse approaches, they'll see the sky darken. Temperatures may drop by more than five degrees.

Meanwhile, scientists will use this chance to study the Sun's corona, or outer atmosphere. It's usually impossible to see because the Sun is so bright. They want to better understand why the corona can reach temperatures of millions of degrees. Yet the Sun's surface hovers at around 5500 degrees Celsius. They are also planning experiments involving animal noises. What do they expect to hear? More cricket sounds because many cricket species search for mates in twilight.

They aren't sure exactly what else the eclipse will bring. But unlike the ancient Greeks, they see it as a learning experience – not something to fear. ★

DEFINITIONS

NASA: National Aeronautics and Space Administration – an independent agency of the U.S. federal government responsible for the civil space program, aeronautics research, and space research

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COMPREHENSION QUESTIONS

1. Describe the shape of the Moon's orbit around the Earth;

2. When the Moon fully blocks the Sun and casts a shadow on part of the Earth, this is called a(n):

3. What is the **path of totality**?

4. When Sun, Moon, and Earth line up and the Moon is at the far point of its orbit and does not fully block the Sun, this is called a(n):

5. The Moon looks slightly different each night and there are four main lunar phases: a) new moon, b) first quarter, c) full moon, and d) last quarter. In which phase does a solar eclipse occur?

6. Why is there no eclipse every time the Moon is in this phase?

7. Where in Canada will the path of totality travel during the total solar eclipse on April 8, 2024?

8. Describe what will happen as the eclipse approaches. How long will the eclipse last?

9. What do scientists plan to study during the eclipse?

10. Why are people in the path of the eclipse warned not to look at the Sun without proper protection?

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QUESTIONS FOR FURTHER THOUGHT

1. The article tells us that the origin of the word "eclipse" comes from the Greek word "ekleipsis" which means 'being abandoned'. What reasons can you suggest to explain why the ancient Greeks might have used this word to describe a total solar eclipse? Explain.

2. A number of school boards in Ontario and Quebec have switched their school calendar to provide a professional activity day for teachers so that students can stay at home on April 8. They are concerned that the projected time of the total solar eclipse will correspond to the student dismissal time for many of their schools. As you see it, why might these school boards have made this decision? Do you agree or disagree with this decision? Give reasons to support your response.

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QUESTIONS FOR ONLINE EXPLORATION

Note: The links below are listed at **www.lesplan.com/links** for easy access.

1. What is a solar eclipse?
https://www.asc-csa.gc.ca/eng/astronomy/eclipses/solar-eclipses.asp

Explain what a solar eclipse is in your own words to a peer.

2. What can we expect on April 8, 2024?
https://www.yout-ube.com/watch?v=fojTobyNJB8 [2:48]
https://www.yout-ube.com/watch?v=DUCLzPInVLQ [1:10]
https://www.theweathernetwork.com/en/news/science/space/how-to-prepare-for-the-april-8-total-solar-eclipse-across-eastern-canada

What did you learn?

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3. Where and at what time will the 2024 total solar eclipse be the most visible?
https://www.asc-csa.gc.ca/eng/astronomy/eclipses/total-solar-eclipse.asp
https://science.nasa.gov/eclipses/future-eclipses/eclipse-2024/where-when/
https://www.yout-ube.com/watch?v=AwlGxVcVNNw [1:08]

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4. Explore the Harvard University LightSound Project site and learn how to build a LightSound Device:
https://astrolab.fas.harvard.edu/LightSound.html#about

What did you find interesting?

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5. Check out these classroom resources for educators on different types of eclipses:
https://www.asc-csa.gc.ca/eng/youth-educators/toolkits/solar-and-lunar-eclipses/
https://letstalkscience.ca/search/site?keys=eclipse&op=Search

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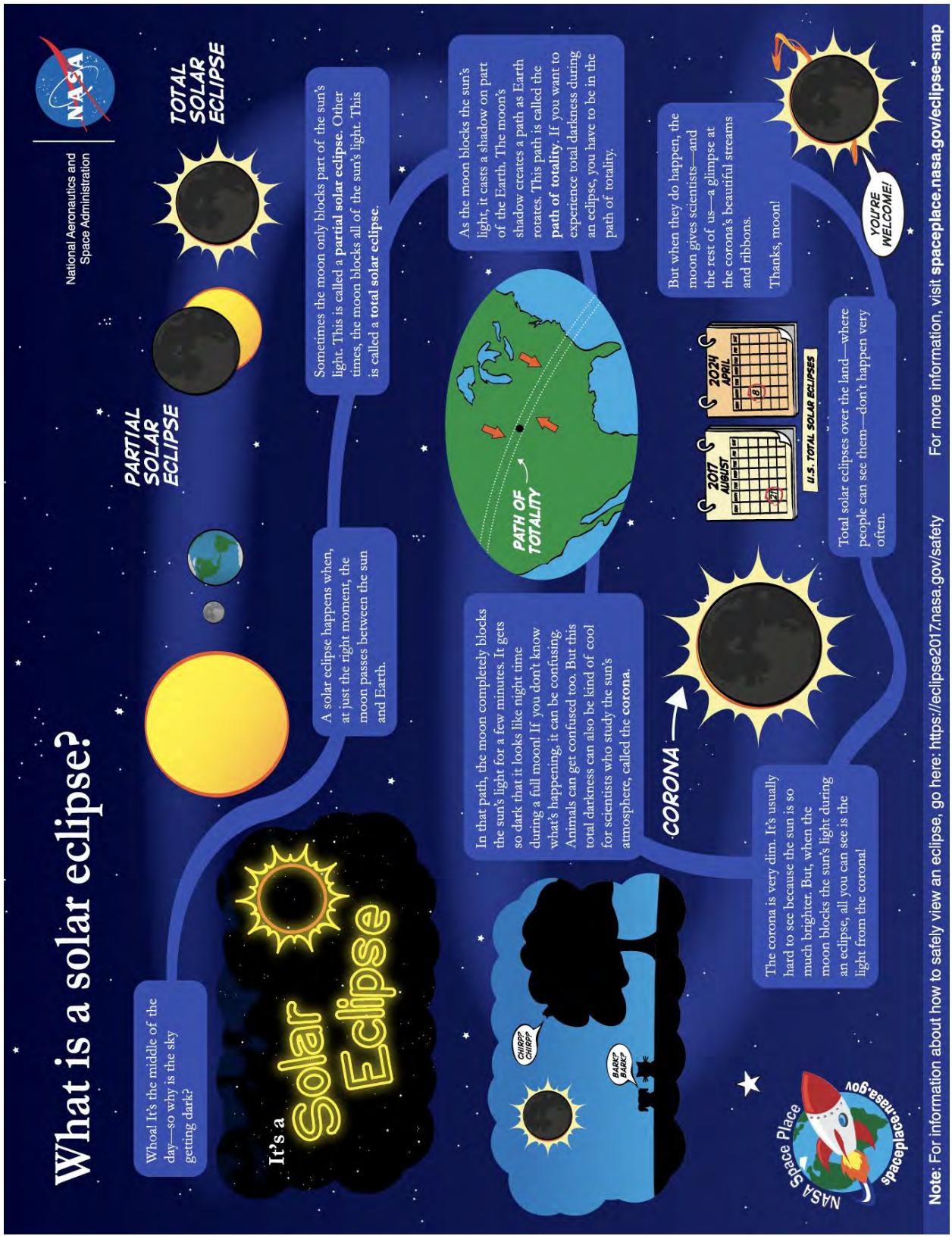
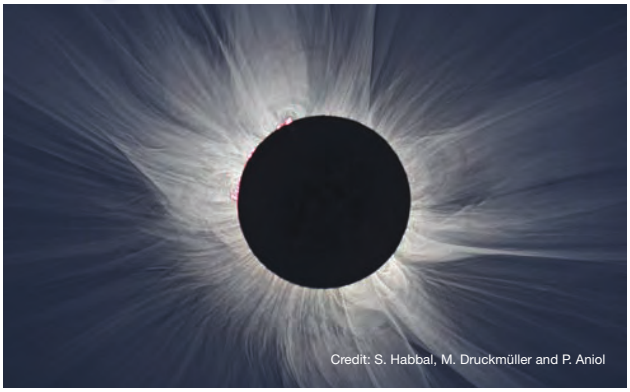
INFOGRAPHIC



https://mynasadata.larc.nasa.gov/interactive-models/observing-sun-during-total-solar-eclipse

Experience a Solar Eclipse


Credit: S. Habbal, M. Druckmüller and P. Aniol

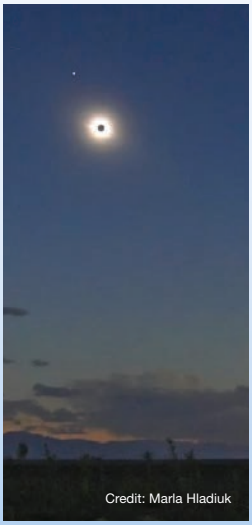
WHAT IS A SOLAR ECLIPSE?

A solar eclipse happens when the Moon moves between the Sun and Earth, casting a shadow on Earth, fully or partially blocking the Sun's light in some areas. There are different types of solar eclipses.

Total Solar Eclipse
For a total eclipse to take place, the Sun, Moon, and Earth must be in a direct line. The people who see the total eclipse are in the center of the Moon's shadow when it hits Earth. The sky will become very dark, as if it were night. Weather permitting, people in the path of a total solar eclipse can see the Sun's corona, the outer atmosphere of the Sun. A total solar eclipse is the only type of solar eclipse where viewers can watch without their eclipse glasses – and they can only remove them when the Moon is completely blocking the Sun.

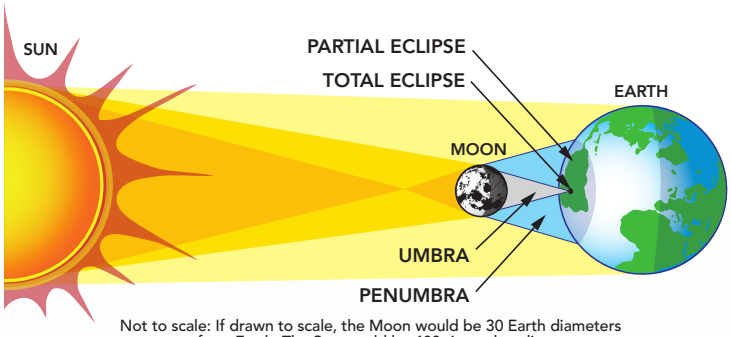
Annular Solar Eclipse
An annular eclipse happens when the Moon is lined up between the Sun and Earth, but at its farthest point from Earth. Because the Moon is farther away from Earth, it seems smaller. It does not block the entire view of the Sun. The Moon in front of the Sun will look like a dark disk on top of a larger, bright disk. This creates what looks like a ring around the Moon.

Known as a hybrid eclipse, sometimes an eclipse can shift between annular and total as the Moon's shadow moves across Earth's surface.

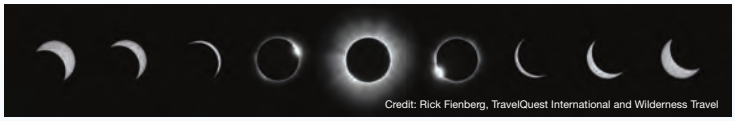

Credit: Marla Hladiuk

Partial Solar Eclipse
This happens when the Sun, Moon and Earth are not exactly lined up. The Sun will appear to have a dark shadow on only part of its surface. During a total or annular solar eclipse, people outside the Moon's inner shadow see a partial solar eclipse.

TOTAL SOLAR ECLIPSE



Not to scale: If drawn to scale, the Moon would be 30 Earth diameters away from Earth. The Sun would be 400 times that distance.


Credit: Rick Fienberg, TravelQuest International and Wilderness Travel
In this series of stills from 2013, the eclipse sequence runs from right to left. The center image shows totality; on either side are the 2nd contact (right) and 3rd contact (left) diamond rings that mark the beginning and end of totality respectively.

WHERE TO WATCH
Find a nice, clear spot with a good view of the sky.

HOW TO WATCH
You can see the Sun and an eclipse with special eclipse or solar viewing glasses. NEVER look directly at the Sun without appropriate eyewear. Regular sunglasses are not safe to view an eclipse. *https://go.nasa.gov/342otvS*

HOW LONG WILL IT LAST
A total eclipse, when the Sun is completely blocked by the Moon, will last up to a few minutes, depending on your location.


Credit: International Space Station
This photo taken from the International Space Station shows the Moon's umbral, or inner, shadow during the total solar eclipse of March 29, 2006.

https://science.nasa.gov/learn/heat/resource/eclipse-fact-sheet/

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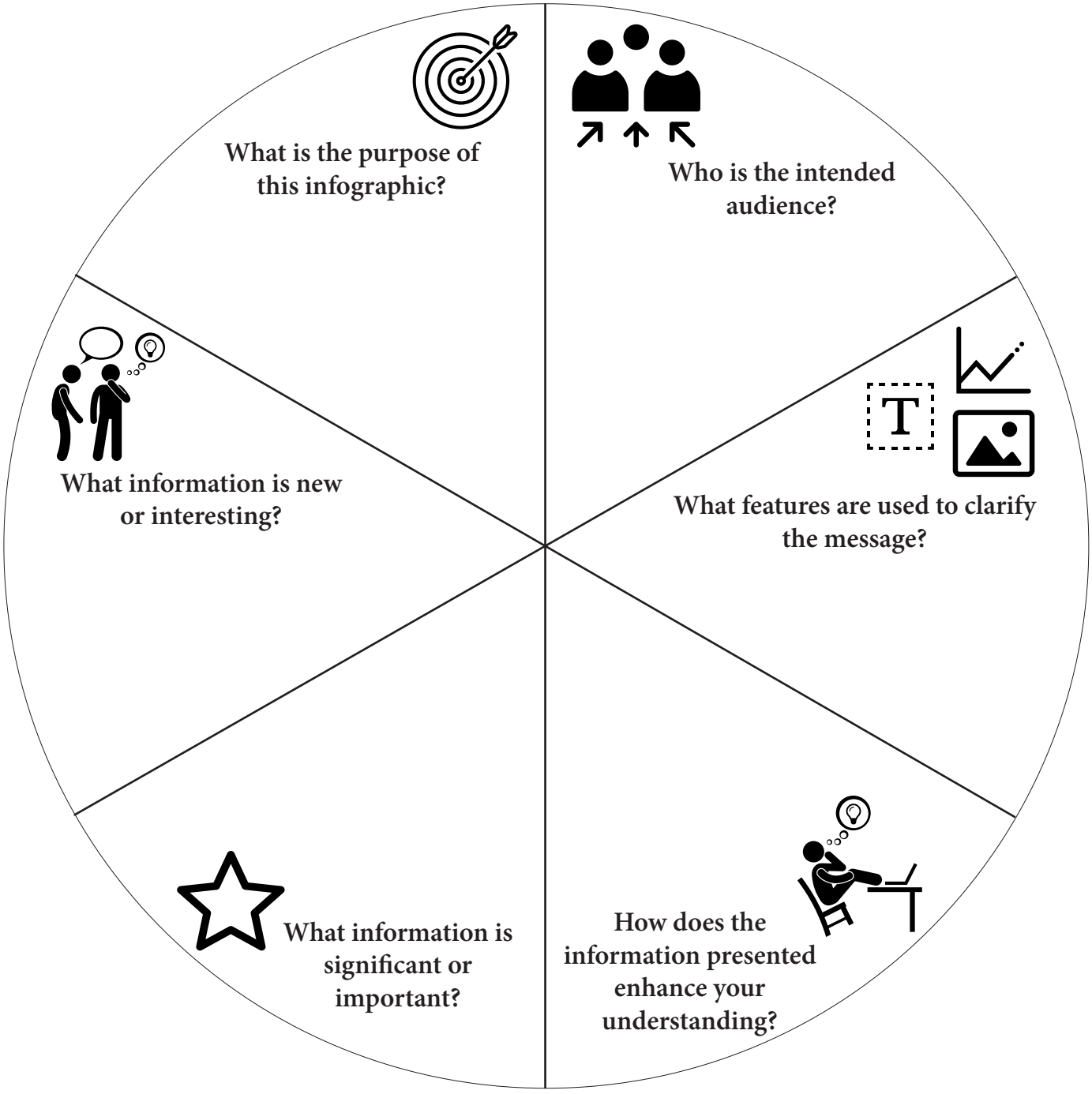
ANALYZING AN INFOGRAPHIC



What questions do you still have about the topic presented?

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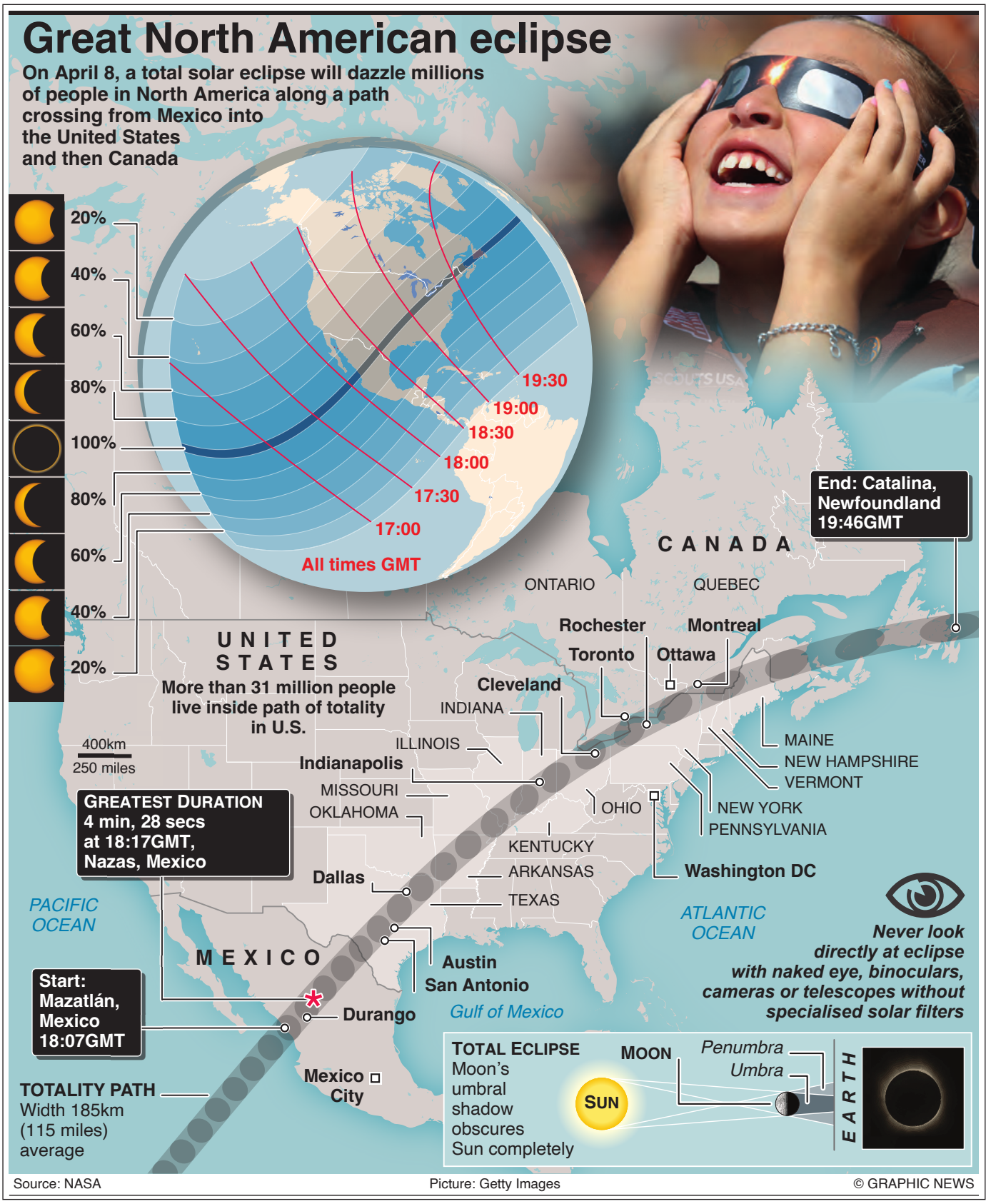

Source: NASA | Picture: Getty Images | © GRAPHIC NEWS

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PUTTING IT ALL TOGETHER

A. Write the letter that corresponds to the best answer on the line beside each question:

_____ 1. **Which of the following is TRUE about a total solar eclipse?**

a) it often recurs in the same place
b) the Moon blocks the view of the Sun
c) it cans last up to 10 minutes
d) it occurs with each new moon phase

_____ 2. **The Sun's outer atmosphere is called the:**

a) corona
b) sunspot region
c) ring of fire
d) solar flare band

_____ 3. **Why will total eclipses no longer occur in the distant future?**

a) the Moon's orbit is slowing
b) space dust will hide the eclipse
c) the Sun is moving farther away
d) the Moon is becoming more distant each year

B. Mark the statements T (True) or F (False). If a statement is True, write one important fact to support it on the line below. If a statement is False, write the words that make it true on the line below.

_____ 5. **True** or **False?** A solar eclipse can only occur during a full moon phase.

_____

_____ 5. **True** or **False?** The surface of the Sun is hotter than its atmosphere.

_____

_____ 6. **True** or **False?** Infrared radiation from the Sun can cause permanent eye damage.

_____

C. Fill in the blanks to complete each sentence.

7. The path of _____ is the location on Earth where a solar eclipse is complete.

8. The Moon's orbit around Earth is _____ shaped.

9. NASA: National Aeronautic and _____ Administration.

D. Respond to the following question in paragraph form. ***(Use a separate sheet of paper if necessary.)***

10. What is your understanding of how a solar eclipse occurs? Explain.

_____

_____

_____

_____

_____