π IN THE SKY [10]

Dig into the volume of this Martian rock sample, and

see for yourself what's possible with pi!

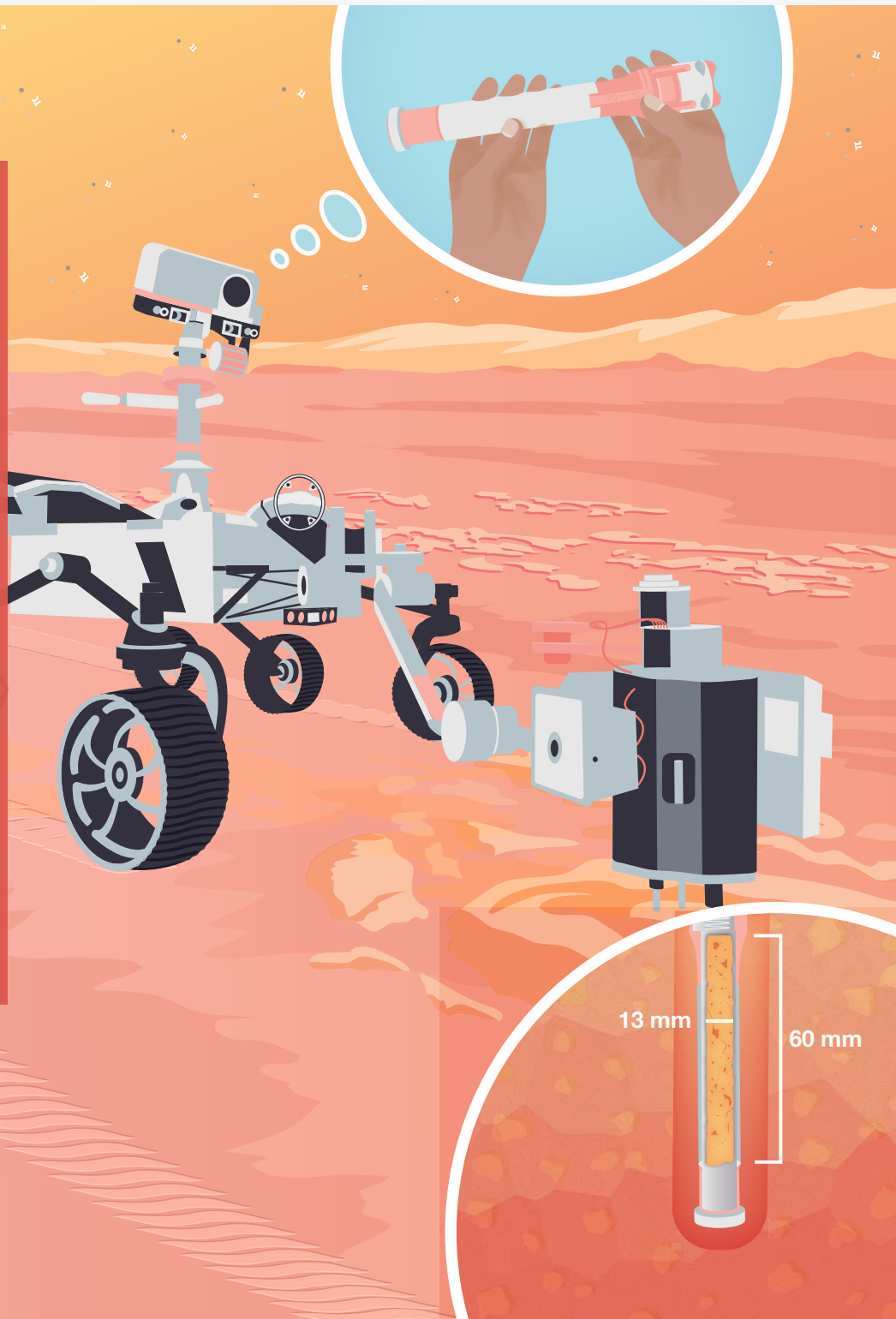**EXPLORE MORE: jpl.nasa.gov/edu**

TUBULAR TALLY

The Perseverance Mars rover is designed to collect rock samples that will eventually be brought to Earth for further study. This would be the first time we've ever brought back samples from Mars!

After scientists identify an interesting rock they would like the rover to collect, Perseverance uses a special coring bit to drill out a rock cylinder 13 mm in diameter. As the rover drills, the rock core moves into one of 38 available tubes that will store the rock sample – sealed until it is opened one day in a lab on Earth.

If the coring bit collects a rock cylinder 60 mm in length, **what is the volume of the rock in the sample tube?**
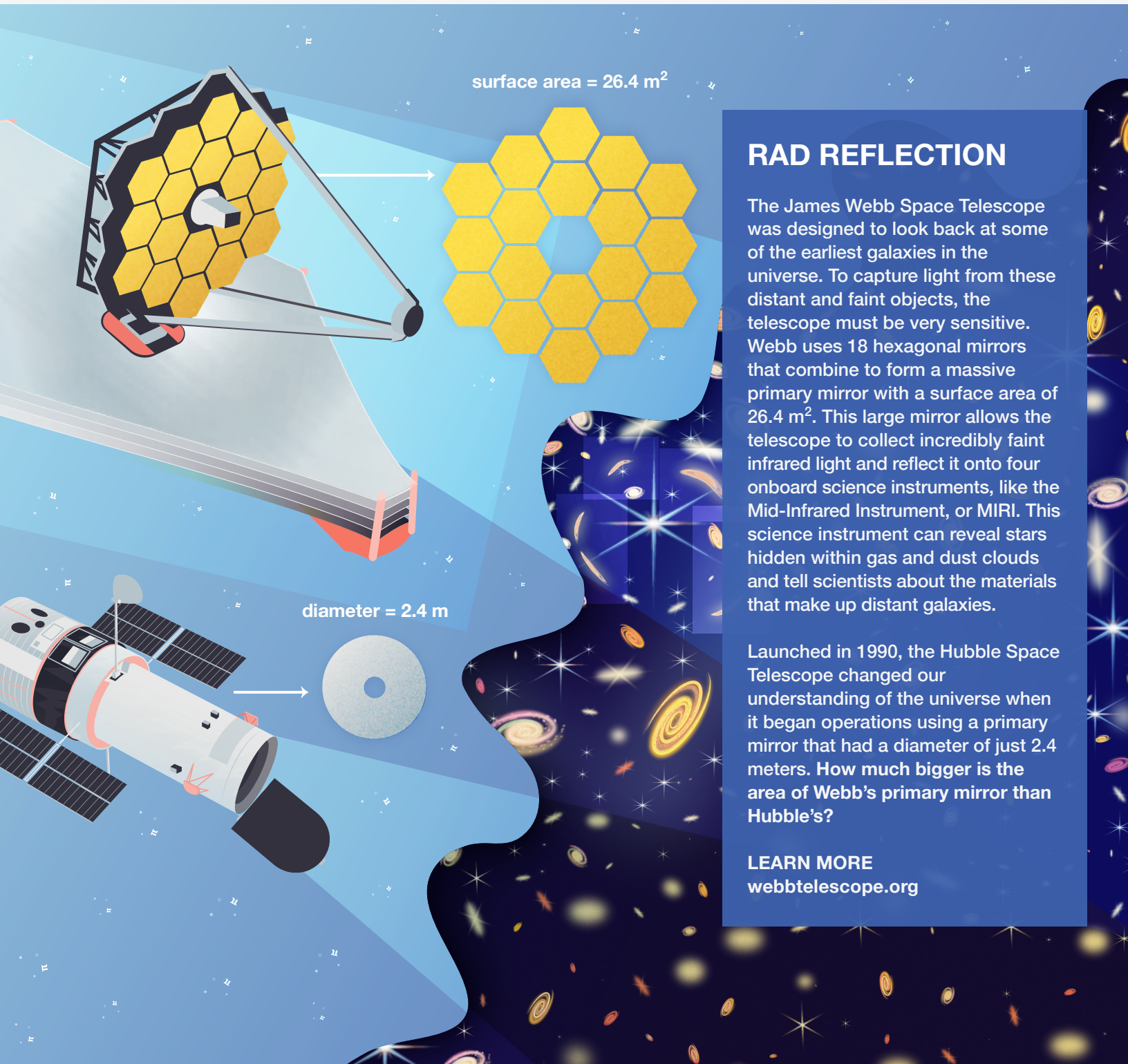
LEARN MORE
mars.nasa.gov/mars2020

13 mm

60 mm

π IN THE SKY [10]

Gain a new perspective on how we explore the cosmos,
and see for yourself what's possible with pi!
EXPLORE MORE: jpl.nasa.gov/edu

surface area = 26.4 m^2

diameter = 2.4 m

RAD REFLECTION

The James Webb Space Telescope was designed to look back at some of the earliest galaxies in the universe. To capture light from these distant and faint objects, the telescope must be very sensitive. Webb uses 18 hexagonal mirrors that combine to form a massive primary mirror with a surface area of 26.4 m^2. This large mirror allows the telescope to collect incredibly faint infrared light and reflect it onto four onboard science instruments, like the Mid-Infrared Instrument, or MIRI. This science instrument can reveal stars hidden within gas and dust clouds and tell scientists about the materials that make up distant galaxies.

Launched in 1990, the Hubble Space Telescope changed our understanding of the universe when it began operations using a primary mirror that had a diameter of just 2.4 meters. **How much bigger is the area of Webb's primary mirror than Hubble's?**

LEARN MORE
webbtelescope.org

π IN THE SKY¹⁰

Deduce an asteroid's makeup from afar, and

see for yourself what's possible with pi!

EXPLORE MORE: jpl.nasa.gov/edu

METAL MATH

Asteroid (16) Psyche is of particular interest to scientists because ground-based observations indicate that the surface may be metallic. Earth and other terrestrial planets have metal cores, but they are buried deep inside the planets, so they are difficult to study. If Psyche consists of a large amount of metal, it might resemble a planetary core from which we could learn about terrestrial planet core formation. Determining how much metal exists on the asteroid is one of the goals of NASA's Psyche mission.

Psyche has a roughly triaxial ellipsoid shape with axes of about 290 km, 245 km, and 170 km. Its mass, as estimated from its gravitational effects on nearby bodies such as Mars, is about 2.7×10^{19} kg. Use the formula for volume, $V = 4/3\, \pi abc$, where a, b, and c are the lengths of the semi-axes, to **compute Psyche's approximate density.**

Based on the average density of terrestrial materials (shown in the graphic), **does Psyche's density support the observations indicating the presence of metal?**

LEARN MORE
psyche.asu.edu


```
analyzing asteroid makeup ...
comparing density to ...
    ice: 917 kg/m^3
    water: 997 kg/m^3
    rock: 1600 — 3500 kg/m^3
    metal: 534 — 22,590 kg/m^3
result ■
```

π IN THE SKY¹⁰

Size up a stellar sight, and see for yourself what's possible with pi!

EXPLORE MORE: jpl.nasa.gov/edu

Remember: Never look directly at the Sun without proper eye protection!

ECLIPSING ENIGMA

A solar eclipse occurs when the Moon passes between Earth and the Sun, fully or partially blocking the Sun's light from our perspective. Because Earth's orbit around the Sun and the Moon's orbit around Earth are not perfect circles, the distances between them change throughout their orbits. During a total eclipse, the distances are such that the Moon covers all of the Sun's disk area. When the Moon is farther from Earth during an eclipse, it leaves a glowing ring of sunlight shining around the Moon, resulting in an annular eclipse.

On Oct. 14, 2023, a solar eclipse will be visible across North and South America. The Sun, with a radius of 695,700 km, will be 148,523,036 km from Earth. The Moon, with a radius of 1,737 km, will be 388,901 km from Earth. **What percentage of the Sun's disk area will be obscured by the Moon? Will the eclipse be an annular eclipse or a total eclipse?**

LEARN MORE
solarsystem.nasa.gov/eclipses