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1. Overview of Venus

- Position in Solar System: 2nd planet from the Sun
- Distance from Sun: ~108.2 million km (0.72 AU)
- Orbital Period: 225 Earth days (1 Venus year)
- Rotation Period: 243 Earth days (Retrograde rotation – spins opposite to most planets)
- Diameter: 12,104 km (95% of Earth’s size)
- Gravity: 8.87 m/s² (91% of Earth’s)
- Temperature:
    - Surface: ~465°C (869°F) – Hottest planet in the solar system
- Moons: None
- Atmosphere: Thick and toxic (mainly carbon dioxide with clouds of sulfuric acid)

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2. Key Characteristics

- Size: Slightly smaller than Earth (Earth's "sister planet").
- Surface: Volcanic plains, mountains, craters, and vast highland regions.
- Color: Yellowish due to thick clouds reflecting sunlight.
- Rotation:
    - Slowest rotation of any planet.
    - Retrograde spin: Sun rises in the west and sets in the east.
- No Magnetic Field: Minimal intrinsic magnetic field.

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3. Orbital and Rotational Facts

- Orbital Speed: 35 km/s
- 1 Venus Day: Longer than its year (243 Earth days to rotate once).
- Axial Tilt: 177° (almost upside down).
- Eccentricity: Nearly circular orbit.

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4. Atmosphere and Greenhouse Effect

- Composition:
    - 96.5% Carbon Dioxide (CO_2)
    - 3.5% Nitrogen
    - Trace gases: Sulfur dioxide (SO_2), water vapor
- Pressure: 92 times Earth's atmospheric pressure (equivalent to 900 m underwater).
- Greenhouse Effect:
    - Thick atmosphere traps heat, creating extreme surface temperatures.
    - Reflects 75% of sunlight, making Venus the brightest planet seen from Earth.

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5. Surface and Geological Features

- Volcanoes:
  - Maat Mons – Largest volcano (8 km high).
  - Possible ongoing volcanic activity.
- Plains: Vast lava plains and domes.
- Craters: Few impact craters due to the thick atmosphere burning most meteors.
- Tesserae: Tectonic ridges unique to Venus.

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6. Temperature and Climate

- Surface Temperature: 465°C (hotter than Mercury).
- No Significant Variation: Similar temperatures day or night, pole to equator.
- Wind Speed: 360 km/h in the upper atmosphere (super-rotation of clouds).

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7. Exploration of Venus

- Mariner 2 (1962): First successful flyby (NASA).
- Venera Missions (USSR):
  - Venera 7 (1970): First spacecraft to land on Venus.
  - Venera 9 (1975): First images from the surface.
- Magellan (1990): Mapped 98% of Venus’ surface using radar.
- Future Missions:
  - VERITAS (NASA): Launching 2031 to map surface.
  - EnVision (ESA): Scheduled for the 2030s.

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8. Interesting Facts

- Brightest Object in the Sky (after the Sun and Moon): Known as the “Evening Star” or “Morning Star.”

- Runaway Greenhouse Effect: Atmosphere traps so much heat that it surpasses Mercury’s temperature.
- Opposite Spin: Rotates clockwise unlike most planets (retrograde rotation).
- Closest to Earth: Venus is Earth’s nearest planetary neighbor.

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9. Why is Venus Important?

- Study of Climate: Helps scientists understand the runaway greenhouse effect.
- Planetary Formation: Reveals insights about Earth-sized planets in other solar systems.
- Volcanism: Venus may still have active volcanoes, shaping its surface.

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10. Key Measurements

Property	Value
Diameter	12,104 km
Distance from Sun	108.2 million km (0.72 AU)
Orbital Period	225 Earth days
Rotation Period	243 Earth days
Gravity	8.87 m/s²
Surface Temperature	465°C
Atmospheric Pressure	92 bar (900 m underwater)
Moons	0

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11. Venus in Mythology and Culture

- Named After: Venus, the Roman goddess of love and beauty (Greek: Aphrodite).
- Cultural Symbolism:
  - Often associated with femininity and beauty.
  - Astrological symbol: ♀

12. Differences Between Venus and Earth

Feature	Venus	Earth
Atmosphere	96.5% CO_2, 3.5% N_2	78% N_2, 21% O_2
Surface Temp.	465°C	15°C
Pressure	92 times Earth’s	1 bar
Rotation	Retrograde (243 days)	Prograde (24 hours)
Magnetic Field	Weak	Strong
Moons	0	1

13. Can Venus Support Life?

- Surface: Hostile for life (extreme heat and pressure).
- Upper Atmosphere: Potential for microbial life in the cooler cloud layers (speculated by scientists).