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1. Overview of Jupiter

- Position in Solar System: 5th planet from the Sun
- Distance from Sun: ~778.5 million km (5.2 AU)
- Orbital Period: 11.86 Earth years
- Rotation Period: 9.9 hours (Fastest spinning planet)
- Diameter: 142,984 km (11 times Earth’s size)
- Gravity: 24.8 m/s² (2.5 times Earth’s)
- Temperature:
    - Cloud Tops: -145°C (-234°F)
- Moons: 95 (Confirmed, as of 2023)
- Atmosphere: Hydrogen (90%) and Helium (10%)

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2. Key Characteristics

- Gas Giant: Composed mainly of hydrogen and helium, lacking a solid surface.
- Largest Planet: Accounts for more than twice the mass of all other planets combined.
- Color Bands: Created by ammonia clouds in different atmospheric layers.
- Axial Tilt: 3.13° (Minimal seasons).
- Wind Speeds: Exceed 600 km/h (373 mph) at the equator.

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3. The Great Red Spot

- Massive Storm: Larger than Earth.
- Active for Over 350 Years: Winds reach up to 432 km/h (268 mph).
- Shrinking: Gradually decreasing in size but remains prominent.

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4. Rings of Jupiter

- Faint and Thin: Made of dust, not ice (unlike Saturn’s).
- Main Components: Halo ring, main ring, and two gossamer rings.
- Formation: Created by dust from meteoroid impacts on Jupiter’s inner moons.

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5. Orbital and Rotational Facts

- Fast Rotation: Causes the planet to bulge at the equator and flatten at the poles.
- Orbital Speed: 13.1 km/s
- Synodic Period (Visible from Earth): 13 months

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6. Atmosphere and Climate

- Composition:
  - 90% Hydrogen
  - 10% Helium
  - Trace amounts of methane, ammonia, and water vapor
- Cloud Layers:
  - Ammonia Crystals: White zones
  - Ammonium Hydrosulfide: Reddish-brown belts
- Lightning: 1,000 times more powerful than Earth’s.

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7. Internal Structure

- Core: Possibly rocky and metallic, surrounded by metallic hydrogen.
- Metallic Hydrogen Layer: Generates a strong magnetic field.
- Outer Layers: Molecular hydrogen and helium.

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8. Moons of Jupiter

- Galilean Moons (Largest and Most Famous):
  - Io: Volcanically active, hottest moon in the solar system.
  - Europa: Covered in ice with a subsurface ocean (potential for life).
  - Ganymede: Largest moon in the solar system, larger than Mercury.
  - Callisto: Heavily cratered, possibly with subsurface oceans.
- Other Moons: Small irregular moons captured by Jupiter’s gravity.

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9. Exploration of Jupiter

- Pioneer 10 & 11 (1973-74): First flybys.
- Voyager 1 & 2 (1979): Detailed images of Jupiter and its moons.
- Galileo (1995-2003): Orbited Jupiter for 8 years.

- Juno (2016 – Present): Currently studying Jupiter’s atmosphere, magnetic field, and interior.
- Future Missions:
    - Europa Clipper (2024): Focus on Europa’s habitability.
    - JUICE (ESA, 2023): Exploring Ganymede, Europa, and Callisto.

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10. Interesting Facts

- Largest Magnetic Field: 20,000 times stronger than Earth’s, extending far beyond Saturn’s orbit.
- Auroras: Massive auroras at Jupiter’s poles, fueled by volcanic activity on Io.
- Gravitational Influence: Protects inner planets by deflecting comets and asteroids.
- Shortest Day: Jupiter’s rotation is the fastest of all planets, completing a day in just under 10 hours.

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11. Why is Jupiter Important?

- Solar System Formation: Jupiter’s composition reflects the early solar nebula.
- Protective Barrier: Acts as a shield, diverting or capturing comets that could threaten Earth.
- Potential for Life: Europa and Ganymede may harbor life in their subsurface oceans.

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12. Key Measurements

Property	Value
Diameter	142,984 km
Distance from Sun	778.5 million km (5.2 AU)
Orbital Period	11.86 Earth years
Rotation Period	9.9 hours

Property	Value
Gravity	24.8 m/s²
Surface Temperature	-145°C
Moons	95
Magnetic Field	Largest in Solar System

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13. Jupiter in Mythology and Culture

- Named After: Jupiter, the Roman king of gods (Greek: Zeus).
- Symbol: ♃
- Astrological Significance: Associated with growth, abundance, and luck.
- Cultural References: Frequently appears in mythology, literature, and science fiction (e.g., 2001: A Space Odyssey).

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14. Differences Between Jupiter and Earth

Feature	Jupiter	Earth
Atmosphere	Hydrogen, Helium	78% N_2, 21% O_2
Surface Temp.	-145°C	15°C
Gravity	24.8 m/s²	9.8 m/s²
Moons	95	1
Magnetic Field	Extremely Strong	Moderate
Surface	No solid surface	Rocky

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15. Can Jupiter Support Life?

- Surface: No solid surface – composed entirely of gas.
- Moons (Potential for Life): Europa and Ganymede have subsurface oceans beneath their icy crusts, making them prime candidates for extraterrestrial life.