

Asteroids, Asteroid Belt, Kuiper Belt, Comets, Meteoroid, Meteor and Meteorite

What are asteroids?

- Rocky leftovers from when the Solar System formed.
- Mostly found in a ring between Mars and Jupiter called the Asteroid Belt.
- Didn't form into a planet because Jupiter's gravity kept them scattered.

Asteroid Makeup

- Mainly rock and metal, some have ice.
- Also called "planetoids" by scientists.

Ceres: The Exception

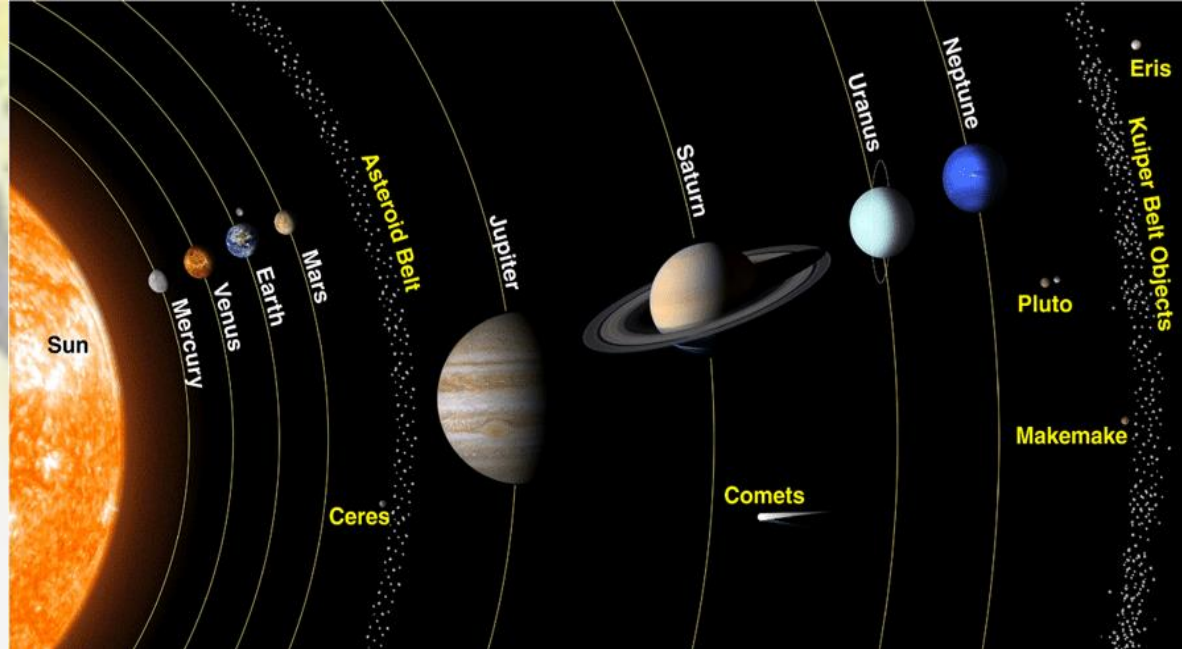
- Biggest asteroid (about 946 km across).
- Large enough to be round due to its own gravity.
- Classified as both a dwarf planet and an asteroid.



Lets Try some Question

1. Most asteroids orbit the sun in a girdle between:

- A. Mars and Jupiter B. Jupiter and Saturn C. Earth and Mars D. Mercury and Venus



2. [UPSC Prelims 1997] The group of small pieces of rock revolving round the sun between the orbits of Mars and Jupiter are called:

- a. Meteors
- b. comets
- c. meteorites
- d. asteroids

3. [UPSC Prelims 1998] Consider the following statements regarding asteroids:

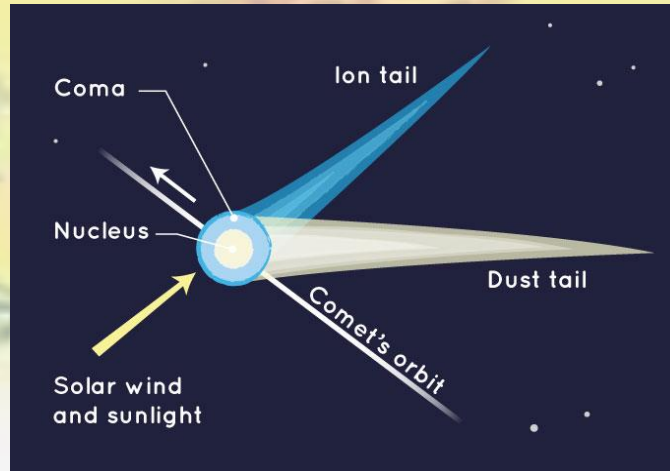
- Asteroids are rocky debris of varying size orbiting the sun
- Most of the asteroids are small, but some have diameters as large and 1000 km
- The orbit of asteroids lies between the orbits of Jupiter and Saturn

Of these statements:

- a. 1, 2 and 3 are correct
- b. 2 and 3 are correct
- c. 1 and 2 are correct
- d. 1 and 3 are correct

COMETS

- Comets are comparatively small, flimsy, erratically shaped bodies. They are the leftovers from the solar system formation. Comets are icy balls that form in the outer solar system. They have icy and very cold surface entrenched with grit, dust & particles from space.
- Several comets have elliptical orbit. Example: Halley's Comet is arguably the most famous comet. It is a "periodic" comet and returns to Earth's vicinity about every 75 years, making it possible for a human to see it twice in his or her lifetime. The last time it was here was in 1986, and it is projected to return in 2061.



COMET

A Mass of ice, rock and dust drifting in space that often has a **tail**, which grows as it gets closer to the Sun. The tail is made up of water, dust and various gases vaporized by solar energy.



ASTEROID

A body made up of rocks, both metallic and non-metallic, that orbits the Sun, usually in the **asteroid belt** between **Mars and Jupiter**. Some Asteroids are Comet Nuclei. They range in size from a few centimeters to a thousand kilometers.

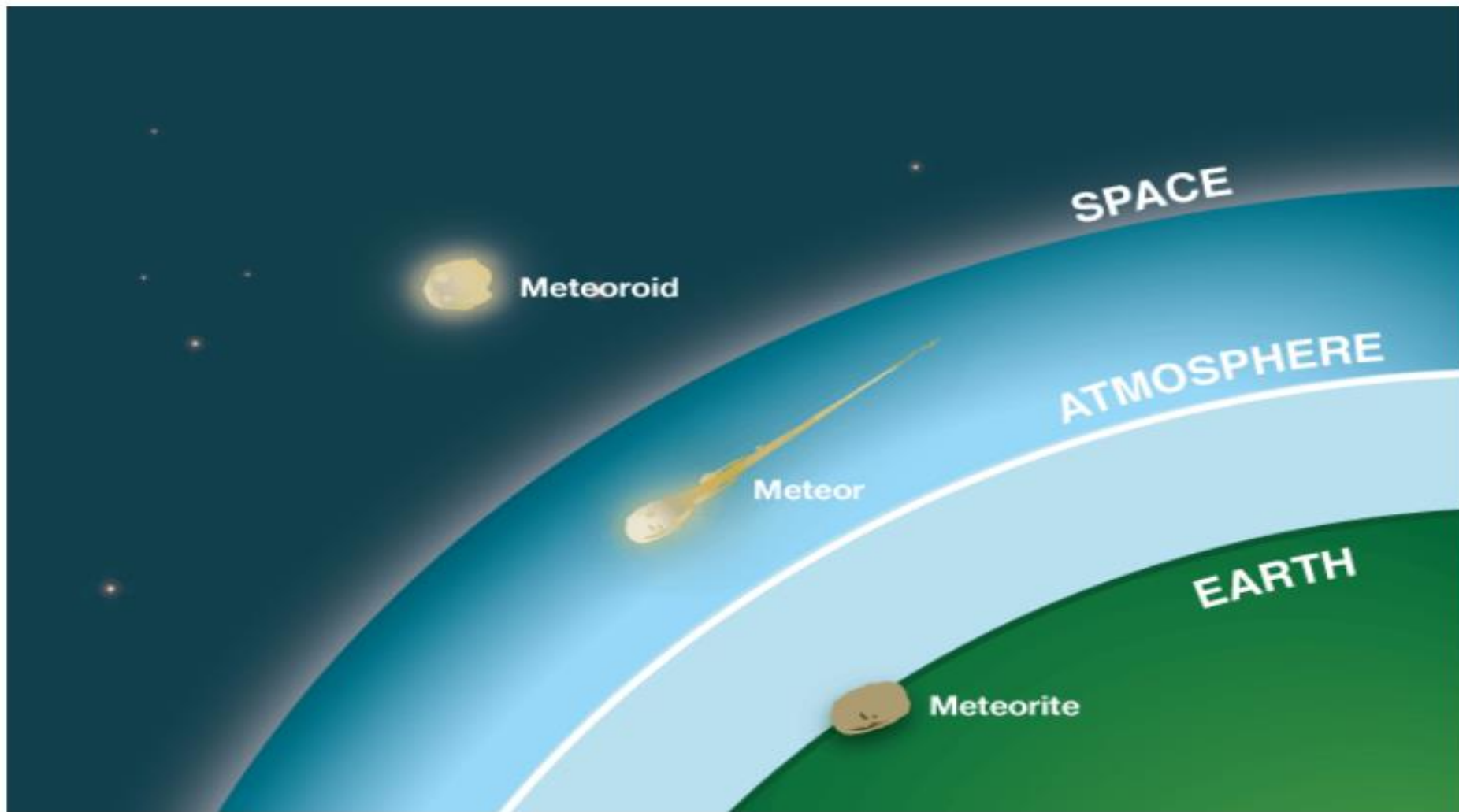


The Journey: Meteoroid -> Meteor -> Meteorite

- **Meteoroid:** A space rock (from asteroids, comets, or other objects) floating in space.
- **Meteor:** The streak of light we see when a meteoroid enters Earth's atmosphere and burns up due to friction. Also called a "shooting star".
- **Meteorite:** If a meteoroid doesn't fully burn up and a piece reaches Earth's surface, it's called a meteorite.

Impact Craters

- Meteorites can create large craters on impact.
- Famous meteorite craters in India:
 - Lonar Lake, Maharashtra
 - Dhala Crater, Madhya Pradesh
 - Ramgarh Crater, Rajasthan



Lets Try some Questions

4. Some rocky fragments that endure passage through the atmosphere of Earth & hit the ground are known as:

A. Meteors B. Meteoroids C. Meteorites D. Fireballs

5. [UPSC Prelims 1995] A meteor is:

- a. a rapidly moving star
- b. a piece of matter which has entered the earth's atmosphere from outer space
- c. part of a constellation
- d. a comet without a tail

6. [UPSC Prelims 2011] What is difference between asteroids and comets?

- Asteroids are small rocky planetoids, while comets are formed of frozen gases held together by rocky and metallic material.
- Asteroids are found mostly between the orbits of Jupiter and Mars, while comets are found mostly between Venus and Mercury.
- Comets show a perceptible glowing tail, while asteroids do not.

Which of the statements given above is/are correct?

- 1 and 2 only
- 1 and 3 only
- 3 only
- 1, 2 and 3

The Kuiper Belt

- Located beyond the orbit of Neptune.
- Like a giant, icy version of the asteroid belt.
- Home to many icy objects, including dwarf planets like Pluto.

Pluto

- The largest known object in the Kuiper Belt.
- Used to be considered the ninth planet.
- In 2006, it was reclassified as a dwarf planet because:
 - It meets the other criteria for being a planet.
 - It hasn't cleared the space around its orbit of other objects.

Charon

- Pluto's largest moon.
- So big relative to Pluto that they sometimes orbit each other like a double-planet system.

What is the Goldilocks Zone?

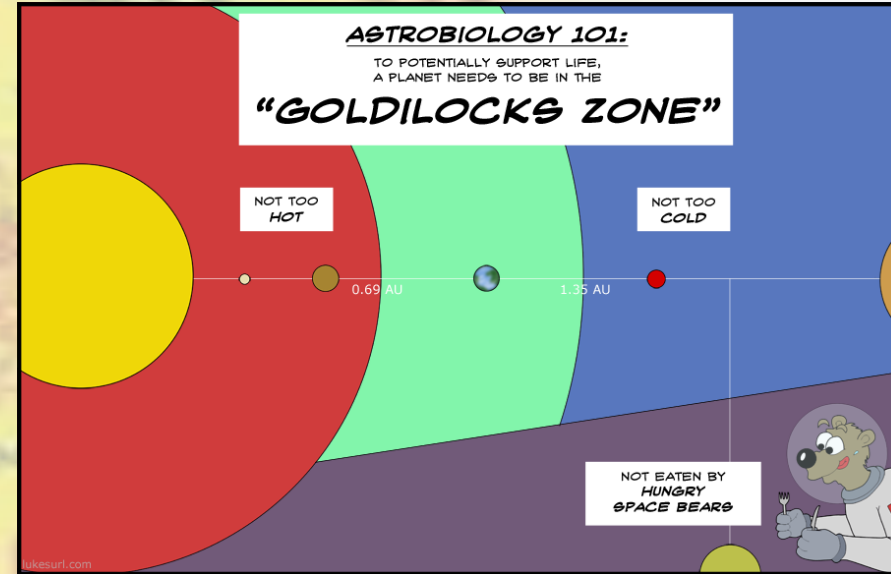
- The area around a star where the temperature is just right for planets to have liquid water.
- Important for life as we know it, because liquid water is essential.

Why "Goldilocks"?

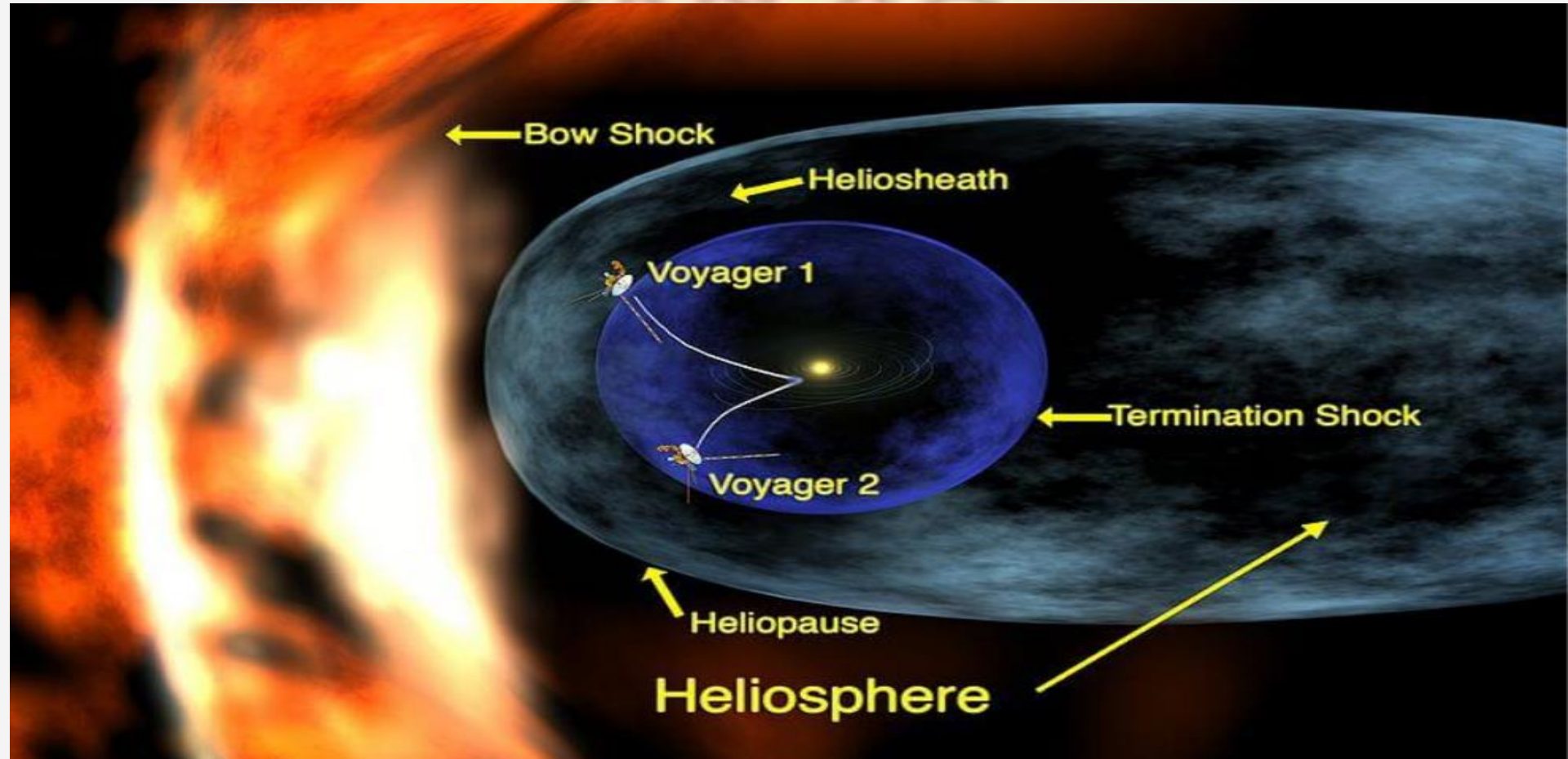
- Think of the story "Goldilocks and the Three Bears": The porridge and beds were either too hot, too cold, or just right. The Goldilocks Zone is where the temperature is "just right" for water.

Earth is a Goldilocks Planet

- Earth's position in our Solar System puts it in the Goldilocks Zone.
- Too close to the Sun (like Mercury): Water would boil away.
- Too far from the Sun (like Pluto): Water would freeze.



Heliopause — The boundary of The Solar System?



Question: What defines the boundary of the solar system? Sun's light? The influence of the Sun's gravity? Or the influence of the Sun's magnetic field & the solar wind?

No Sharp Edge

- Light and gravity from the Sun gradually get weaker with distance, they don't have a sudden stopping point.

The Solar Wind: It's Different

- The solar wind is a stream of particles from the Sun.
- It pushes against the thin gas and dust between stars (the interstellar medium).
- This interaction creates a giant bubble around our solar system called the heliosphere.

The Heliosphere's Shape

- The Sun moves through space, so the heliosphere isn't a perfect sphere.
- It forms a "shock wave" against the interstellar medium, like a boat moving through water.

Parts of the Heliosheath (the outer region of the heliosphere)

- Termination Shock: Where the solar wind slows down to below the speed of sound.
- Heliopause: The very edge of the heliosphere, where the solar wind is fully stopped by pressure from the interstellar medium.
- The Area in Between: The space between the termination shock and the heliopause.

