PLANET & MOON FORMATION

Accretionary Disk Model
How did our solar system come to be?

It all began about 4.6 billion years ago in a wispy cloud of gas and dust. At some point, part of the cloud collapsed in on itself—possibly because the shockwave of a nearby supernova explosion caused it to compress. The result: a flat spinning disk of dust and gas.

When enough material collected at this disk’s center, nuclear fusion began. Our sun was born. It gobbled up 99.8% of all the material.

These clumps became planets, dwarf planets, asteroids, comets, and moons.

This cloud was a small part of a much bigger cloud.

Nuclear fusion occurs when hydrogen atoms fuse into helium.

The material left behind by the sun clumped together into bigger and bigger pieces.

Only rocky things could survive close to the sun, so gaseous and icy material collected further away. That’s how our solar system came to be the place it is today!

Comets and asteroids are the left over remains of the solar system’s formation.

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a large cloud of gas began eventually forming the Sun—at its center while the outer, cooler, parts created the planets.
A cloud of gasses and dust that form a solar system

“Star leftovers”

Ours had all the elements we see today
gravity acting on the mass of an object, compresses it, reducing its size and increasing the object's density
the growth of an object by gravitationally attracting more matter
Strong solar wind from newly born Sun blew away any dust and gas left over to the Oort Cloud!
a planetary piece that has simply gone through growth. oddly-shaped and small. Formed from gas and dust leftovers.
Many of them got captured by an outer planets’ gravity and became one of the many moons now orbiting the giant planets.

Interactions with Uranus and Neptune pushed them out forming the Kuiper belt.

Some of them are still in the Asteroid Belt.
PROTOPLANETS

• Second stage of planets
• Planetary embryos
• Melting to produce layers

After protoplanet formed, accumulation of **heat** from radioactive decay of short-lived elements melted planet, allowing materials to differentiate (to separate according to their density).
“planetary cores”
Vary from planet to planet
Can be liquid or solid
4 Reasons we have planetary layers:

- Heat generated from the impacts (kinetic energy)
- Gravitational compression
- And radiation given off from radioactive decaying.
- Different materials settle to different depths based on their density
Solar Nebular Theory

- a large cloud of interstellar gas began to collapse under the influence of its own gravity.
HOW THE SOLAR SYSTEM FORMED

• became denser and hotter, eventually forming a star—the Sun—at its center. (review on star formations)

Nebula contracts into rotating disk.
HOW THE SOLAR SYSTEM FORMED

- Dust and gasses rotate and collide and coalescence. Also called Accretion.
Thus creating the planets and their moons essentially as by-products of the star-formation process.
How the Solar System Formed

- Areas near sun high in heavier elements (form inner planets)
- Areas far from sun low in heavy elements (form outer planets)
- Asteroid belt contains debris that never formed a planet due to the gravity of Jupiter.
Gravity makes cloud shrink. As it shrinks it spins faster and flattens into a disk with central bulge.

Approx. 100 AU
Bring Playdough for Friday’s Lab
The Moon rotates at the same speed as it revolves around the Earth. So we always see the same side.
Rotation & Revolution:

The Moon’s rotation period is equal to the Moon’s revolution period around the Earth.

29.5 Days

Called a synodic month
So... what does that mean?

- same side of moon always faces Earth
- synchronous orbit
- tidally coupled
**Waxing** - getting bigger

**Waning** - getting smaller
Lunar Surface: 2 regions-
• Maria (plural) (“sea”) - darker blue area Mara (singular)
• Highlands – white area
The Moon has no atmosphere because it does not have sufficient mass to have a strong enough gravity to hold an atmosphere.
Interesting Fact:

- The moon increases its average distance from Earth by about 3.8 cm every year!
Origin of the Moon:

1. Daughter theory
2. Sister theory
3. Capture theory
4. Giant impact theory
The Moon was once part of the Earth and somehow separated (perhaps from impact from an Mars size object) from the Earth early in the history of the Solar System. The present Pacific Ocean basin is the most popular site for the part of the Earth from which the Moon came.
The Moon and the Earth condensed together from the original nebula that formed the Solar System.
The Moon was formed somewhere else, and was later captured by the gravitational field of the Earth.
A planetesimal the size of Mars struck the earth, ejecting large volumes of matter. A disk of orbiting material was formed, and this matter eventually condensed to form the Moon in orbit around the Earth.

*FAVORED HYPOTHESIS*
Why do scientists think so?

the moon’s density is approximately similar to the Earth’s crust and mantle
Mars-size body
Primitive Earth
A
B
C
D
Well, what are you waiting for?! Gravity.