The Solar System

- The Solar System consists of the **Sun**, eight **planets**, their moons, **comets**, **asteroids**, and **meteoroids**.
- It looks like a flat disk with the Sun at the center.

The Sun

- The **Sun** is a **star** at the center of the Solar System, often referred to as a **ball of hot gas**.
- It is about **5 billion years old** and rotates at a central point.
- The Sun contains more than **95% of the total mass** of the Solar System.
- It continuously produces **heat** and **light** through powerful **nuclear reactions**.
- During these reactions, **hydrogen** is changed into **helium**.
- Celestial objects like **meteors**, **asteroids**, and **comets** orbit around the Sun.

Objects Around the Sun

- There are **8 planets** orbiting the Sun, along with their **moons**, **asteroids**, and **dwarf planets**.
- Two main regions beyond the planets are:
    - The **Kuiper Belt**, located beyond **Neptune's orbit**, contains **comets**, **asteroids**, and icy objects.
    - The **Oort Cloud** is a distant region, filled with **rock-ice objects**. It's the origin of comets and named after the Dutch astronomer **Jan Oort**.

Gravity in the Solar System

- **Gravity** is the force that keeps the planets in orbit around the Sun.

HOMEWORK

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1. **What is the Sun?**
   The Sun is a **star** at the center of the Solar System.
2. **How old is the Sun?**
   The Sun is about **5 billion years old**.
3. **Explain the mass of the Sun in relation to the Solar System.**
   The Sun contains more than **95% of the total mass** of the Solar System.
4. **Explain how the Sun produces heat and light.**
   The Sun produces heat and light through **nuclear reactions** that change **hydrogen** into **helium**.
5. **How does the Sun relate to the Solar System?**
   The Sun is at the **center** of the Solar System, and planets, comets, and asteroids **orbit** around it.

HOMEWORK

1. **How many planets are there in our Solar System?**
   There are **eight** planets.
2. **Where do we find the Kuiper Belt and the Oort Cloud?**
   The **Kuiper Belt** and **Oort Cloud** are located at the **edge** of the Solar System.
3. **Why is it called the Oort Cloud?**
   It is named after **Jan Oort**, a Dutch astronomer.
4. **What is the Oort Cloud?**
   The Oort Cloud is a distant, theoretical cloud filled with **rock-ice objects**. It is the **origin of comets**.
5. **Describe the Kuiper Belt.**
   The **Kuiper Belt** is a region beyond **Neptune** filled with **comets**, **asteroids**, and icy bodies.

Objects Around the Sun

Mnemonic for Remembering Planet Order

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- Use the sentence **"My Very Easy Method Just Speeds Up Names"** to remember the planets' order from the Sun:
    - **M**ercury
    - **V**enus
    - **E**arth
    - **M**ars
    - **J**upiter
    - **S**aturn
    - **U**ranus
    - **N**eptune

Satellites and Moons

- A **satellite** is a celestial or artificial body that orbits a planet.
- A **moon** is a natural satellite of a planet.

Planetary Days and Years

- Some planets have days that are longer than their years. For example, on **Venus**, one day is longer than one year.

Planet Information Table

Planet	Number of Moons	Orbit Period around the Sun	Day Length (hours)	Average Temperature (°C)	Distance from the Sun (million km)
Mercury	None	88 days	4222.6	167 °C	57.9
Venus	None	225 days	2802.0	464 °C	108.2
Earth	1	365.25 days	24.0	15 °C	149.6
Mars	2	687 days	24.7	-65 °C	206.6
Jupiter	67	12 years	9.9	-110 °C	740.5

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Planet	Number of Moons	Orbit Period around the Sun	Day Length (hours)	Average Temperature (°C)	Distance from the Sun (million km)
Saturn	62	29 years	17.2	-140 °C	1352.6
Uranus	27	84 years	10.7	-195 °C	2741.3
Neptune	13	166 years	16.1	-200 °C	4444.5

HOMEWORK

1. **What is the third planet from the Sun?**
    - **Earth**
2. **List the 8 planets in their correct order from the Sun.**
    - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
3. **How long is the year on Mars?**
    - **687 days**
4. **Which planet is the furthest from the Sun?**
    - **Neptune**
5. **Discuss the temperatures on different planets and mention which planet's temperature is suitable to live on.**
    - The temperatures range from **167 °C** (Mercury) to **-200 °C** (Neptune). The only planets with temperatures suitable for life are **Earth** and **Mars**. Other planets are either too hot or too cold for life.
6. **Which planet has the longest year?**
    - **Neptune** (166 years)

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7. **Discuss why a year on Mercury is longer than its day.**
    - Mercury takes longer to complete one rotation on its axis than to revolve around the Sun.
8. **Discuss the moons of the 8 planets.**
    - Mercury and Venus have no moons. Earth has 1 moon, Mars has 2, Jupiter has 67, Saturn has 62, Uranus has 27, and Neptune has 13.
9. **How do the distances of the planets from the Sun affect their average temperatures?**
    - Planets closer to the Sun, like Mercury and Venus, have higher temperatures, while those farther away, like Neptune and Uranus, have lower temperatures.

Terrestrial Planets vs Gas Planets

Terrestrial Planets (MVEM)	Gas Planets (JSUN)
Mercury, Venus, Earth, Mars	Jupiter, Saturn, Uranus, Neptune
Metal core, rocky mantle, thin outer crust	Made of hydrogen and helium gas
Thin atmosphere	Less dense than terrestrial planets
No ring systems	Have ring systems around them

10. **Identify the four gas planets and the four terrestrial planets.**

- Terrestrial planets: **Mercury, Venus, Earth, Mars**
- Gas planets: **Jupiter, Saturn, Uranus, Neptune**

11. **Explain the difference between a “gas planet” and a “terrestrial planet.”**

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- **Gas planets** are composed mainly of **hydrogen** and **helium**, while **terrestrial planets** have a **metal core**, a **rocky mantle**, and a thin outer crust.

12. **Which planets have rings around them?**

- **Jupiter, Saturn, Uranus, and Neptune** have ring systems.
-

Earth’s Position in the Solar System and the Milky Way Galaxy

Earth's Position in the Solar System

- Earth’s conditions such as **oxygen**, suitable temperatures, and **water** make it ideal for life.
- The **average temperature** on Earth is about **23 °C**, which supports life and moisture.
- The **highest temperatures** recorded on Earth are **70 °C** in the Iran desert and **68 °C** in Queensland, Australia.
- Organisms on Earth can **produce**, **eat**, and **survive** due to the favorable environmental conditions.
- **Algae** are crucial to the food chain, providing the foundation for **aquatic** and **inland** ecosystems. They produce about **70% of the oxygen** we breathe.
- The **Amazon rainforest** in Brazil is home to over **41,000 plant and animal species**, while the **Kruger National Park** in South Africa is home to over **800 plant and animal species**.

HOMEWORK

1. **What conditions make Earth suitable for life?**
    - Earth’s **average temperature** of 23 °C is suitable for moisture and life, and it has **oxygen** and **water**.
2. **What is the average temperature on Earth?**
    - The average temperature on Earth is **23 °C**.

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3. **What are the highest temperatures on record and where were they recorded?**
    - The highest temperatures recorded are **70 °C** in the Iran desert and **68 °C** in Queensland, Australia.
4. **What role do algae play?**
    - **Algae** provide the foundation for the **aquatic and inland food chains** and produce about **70% of the oxygen** we breathe.
5. **What are some interesting facts about the Amazon and Kruger National Park?**
    - The **Amazon rainforest** in Brazil is home to over **41,000 plant and animal species**.
    - The **Kruger National Park** in South Africa is home to over **800 plant and animal species**.

Beyond the Solar System: The Milky Way Galaxy

- Our **Solar System** is located toward the **edge** of the **Milky Way Galaxy**.
- The **Milky Way Galaxy** is made up of **stars** held together by their **mutual gravity**.
- The Milky Way has a **spiral shape** with many **arms**, and it appears as a flat disk, described by the ancient Greeks as resembling **spilled milk**.
- A **galaxy** is a huge group of stars, with as few as **10 million** to as many as **1 trillion** stars.
- The **Sun** is located in the **Orion spiral arm**, halfway out from the center of the Milky Way.

HOMEWORK

1. **Where is the Solar System located?**
    - The Solar System is found towards the **edge** of the **Milky Way Galaxy**.

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2. **What is the composition of the Milky Way Galaxy?**
    - The Milky Way Galaxy is composed of **stars** held together by their **mutual gravity**.
3. **Describe the structure of the Milky Way Galaxy.**
    - The Milky Way Galaxy is a **flat disk** with **spiral arms** and billions of stars. Ancient Greeks described it as looking like **spilled milk**.
4. **Describe the size of a galaxy.**
    - A **galaxy** contains between **10 million** and **1 trillion stars**, held together by gravity.
5. **Where is the Sun located?**
    - The Sun is located in the **Orion spiral arm**, halfway out from the center of the Milky Way Galaxy.

Telescopes and Space Observation

Telescopes

- **Telescopes** are tools used to **study objects in the universe**, such as planets, stars, and galaxies.
- **Galileo Galilee** was the first scientist to use a telescope to study planets and their moons, although he did not invent it.
- The telescope was originally invented by **Hans Lippershey**, an eyeglass maker from Holland.
- **Clear skies** with **limited light pollution** and **low air pollution** are ideal for using telescopes to observe space.
- Some telescopes use **light** (optical telescopes), while others use **radio waves** (radio telescopes).
- The **Hubble Telescope**, launched in 1990, has been used to take pictures of space and study celestial objects.
- The **James Webb Telescope**, which is 100 times more powerful than the Hubble Telescope, will replace it in the near future.

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HOMEWORK

1. **What is the use of telescopes?**
    - Telescopes are used to **study objects in the universe**.
2. **Who invented the first telescope?**
    - The first telescope was invented by **Hans Lippershey** of Holland.
3. **Which scientist was the first to use a telescope?**
    - **Galileo Galilee** was the first scientist to use a telescope.
4. **How did Galileo use the telescope?**
    - Galileo used a telescope to **study planets** and their **moons**.
5. **When was the Hubble Telescope launched?**
    - The Hubble Telescope was launched in **1990**.
6. **What makes the James Webb Telescope different?**
    - The **James Webb Telescope** is **100 times more powerful** than the Hubble Telescope.

Looking into Space: SALT and SKA

1. **What is the long name for SALT?**
    - **Southern Africa Large Telescope**.
2. **What is the long name for SKA?**
    - **Square Kilometre Array**.
3. **Interesting facts about SALT:**
    - SALT is located near **Sutherland** in South Africa's Karoo region.
    - It is among the **largest telescopes** in the world.

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    - It was **started in 2004** and has helped astronomers discover the **first white dwarf pulsar**.

4. **Interesting facts about SKA:**
    - The **Square Kilometre Array (SKA)** will be built in **South Africa** (near Carnarvon in the Karoo) and **Australia**.
    - SKA will have the **processing power of nearly a million computers**, allowing it to study stars, galaxies, and even detect life elsewhere in the universe.

Astronomer Task: Choosing a Location for a Telescope

When choosing a location to build a telescope, the following conditions should be considered:

- The area must have **clear skies** with **less pollution**.
- **Limited artificial light** is important to reduce light pollution.
- Locations like **Sutherland** and **Carnarvon** in the Karoo are ideal because they have **low population densities**, reducing air and light pollution.

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