NATURAL SCIENCES GRADE 8

LEARNER GUIDE

EARTH AND BEYOND

SOLAR SYSTEM

(a) A **solar system** is a collection of celestial objects bound together by gravity, orbiting a central Sun.

(b) In our case, the Solar System refers to the Sun and everything gravitationally bound to it.

(c) The Solar system refers to the Sun (Sol means Sun in Latin) and the eight planets, moons, comets, asteroids and meteoroids orbiting the Sun.

(d) The solar system looks like a flat disk.

THE SUN

(a) The Sun is classified as yellow dwarf (G dwarf) .

(b) It generates energy through **nuclear fusion**—converting hydrogen into helium in its core.

(c) The Sun is about 109 times wider than the Earth.

(d) The Sun can fit about 1.3 million Earths.

(e) The temperature in the Sun's core is about 15 million °C.

(f) The Sun is believed to be 4.6 billion years old with 5 billion years more to live.

(g) The Sun is about 93 million kilometres away from the Earth.

(h) Light travelling from the Sun takes about 8 minutes and 20 seconds to reach the Earth.

Answer the following questions: Low – order Questions

1. What is the Sun classified as?

   _____

2. How long does it take light to travel from the Sun to the Earth?

   _____

3. How old is the Sun?

   _____

Middle – order questions

4. What is nuclear fusion and why is it important for the Sun?

   _____

   _____

5. Why is the Solar System referred to as the "Solar" System?

   _____

6. How does the size of the Sun compare to Earth?

   _____

7. What is the general shape of the Solar System?

   _____

8. What is the distance between the Sun and Earth in kilometers?

   _____

High – order questions

9. How would life on Earth be affected if the Sun's energy output were to significantly decrease?

   _____

   _____

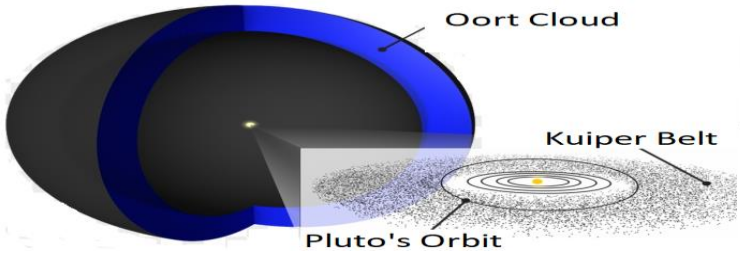
10. How does the concept of nuclear fusion in the Sun influence our understanding of energy generation on Earth?

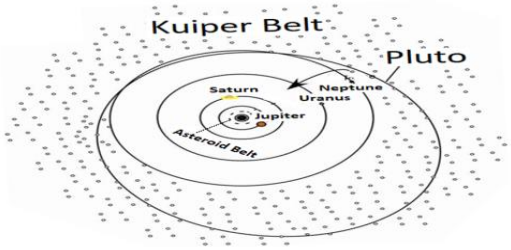
    _____

    _____

SOLAR SYSTEM

Objects around the Sun





(a) There are 8 planets orbiting the Sun, along with moons, asteroids, and dwarf planets.

(b) The Kuiper Belt and Oort Cloud are at the outer edge of the Solar system.

(c) The Kuiper Belt, beyond Neptune, has comets, asteroids, and icy objects.

(d) The Oort Cloud, named after astronomer Jan Oort, is a distant, theoretical cloud.

(e) The Oort Cloud is full of icy rocks and is where many comets come from.

(f) Sometimes, Oort Cloud comets travel near the Sun.

(g) The Sun is in the center, and planets mostly orbit in the same direction, except Uranus and Venus.

(h) Gravity keeps the planets in their orbits around the Sun.

Answer the following questions

Low - Order Questions

1. How many planets orbit the Sun?

   _____

2. What lies beyond Neptune's orbit in the Solar System?

   _____

3. Who was the Oort Cloud named after?

   _____

Middle – Order Questions

4. Why is the Kuiper Belt important in the Solar System?

   _____

   _____

5. How do the orbits of Uranus and Venus differ from the other planets?

_____

_____

6. What role does gravity play in the Solar System?

_____

_____

7. What is the primary difference between the Kuiper Belt and the Oort Cloud?

_____

_____

8. What objects are believed to originate from the Oort Cloud?

_____

9. How do comets from the Oort Cloud sometimes appear near the Sun?

_____

_____

10. What is the relationship between the Sun and the planets in terms of motion?

_____

_____

High – Order Questions

11. What would the Solar System be affected if the Oort Cloud did not exist?

_____

_____

12. How might the discovery of more objects in the Kuiper Belt and Oort Cloud change our understanding of the Solar System?

_____

_____

_____

SOLAR SYSTEM

Objects around the Sun

(a) The phrase "My Very Easy Method Just Speeds Up Names" helps remember the order of the planets, with each word's first letter matching a planet's name.

(b) A satellite is an object, natural or man-made, that orbits a planet.

(c) A moon is a type of satellite.

(d) Some planets, like Venus, have days longer than their years.

(e) The four giant planets (Jupiter, Saturn, Uranus, Neptune) have rings around them.

(f) The first four planets (Mercury, Venus, Earth, Mars) are solid and called rocky planets.

(g) Jupiter and Saturn are gas planets, while Uranus and Neptune are ice planets.

(h) Gas planets are mostly composed of hydrogen and helium, with little to no solid surface.

(i) Ice planets are mainly made of heavier elements like water, ammonia, and methane ices, in addition to hydrogen and helium.

Planet Name	Number of moons	Orbit Period around the Sun	Day length in hours	Average temperature	Distance from the Sun (million km)
1. Mercury	None	88 days	4222.6	167 °C	57.9
2. Venus	None	225 days	2802.0	464 °C	108.2
3. Earth	1	365.25 days	24.0	15 °C	149.6
4. Mars	2	687 days	24.7	- 65 °C	206.6
5. Jupiter	67	12 years	9.9	-110 °C	740.5
6. Saturn	62	29 years	17.2	-140 °C	1352.6
7. Uranus	27	84 years	10.7	-195 °C	2741.3
8. Neptune	13	166 years	16.1	-200 °C	4444.5

Answer the following questions:

1. What is the third planet from the Sun?

   _____

2. List the 8 planets in their correct order from the Sun.

   _____

3. How long is the year in Mars?

_____

4. Which planet is the furthest from the Sun?

_____

5. Discuss the temperatures in the different planets and mention which planet's temperature is suitable to live in.

_____

6. Which planet has the longest year?

_____

7. Discuss why the year in Mercury is longer than its day.

_____

8. Discuss the moons around all the 8 planets.

_____

9. Discuss how the distances of the planets from the Sun affect their average temperatures.

_____

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

_____

11. Explain the difference between a "gas planet" and a "terrestrial planet".

_____

12. Which planets have rings around them?

_____

13. Which planets are known as ice planets?

_____

Activity:

A. Mercury, Venus, Mars, Jupiter and Saturn can be seen without a telescope.

B. Look out for the following planets on the 16th of October 2024

	Planetrise/Planetset, Wed, 16 Oct 2024			
Planet	**Rise**	**Set**	**Meridian**	**Comment**
Mercury	Wed 06:36	Wed 19:48	Wed 13:12	Difficult to see
Venus	Wed 07:51	Wed 21:45	Wed 14:48	Good visibility
Mars	Thu 01:36	Thu 11:45	Thu 06:40	Average visibility
Jupiter	Wed 23:20	Thu 09:28	Thu 04:24	Perfect visibility
Saturn	Wed 15:43	Thu 04:28	Wed 22:05	Perfect visibility
Uranus	Wed 21:25	Thu 07:52	Thu 02:39	Average visibility

Mercury

A. Mercury is only visible in the early morning due to its closeness to the Sun.

B. It would appear as a bright star about an hour before sunrise.

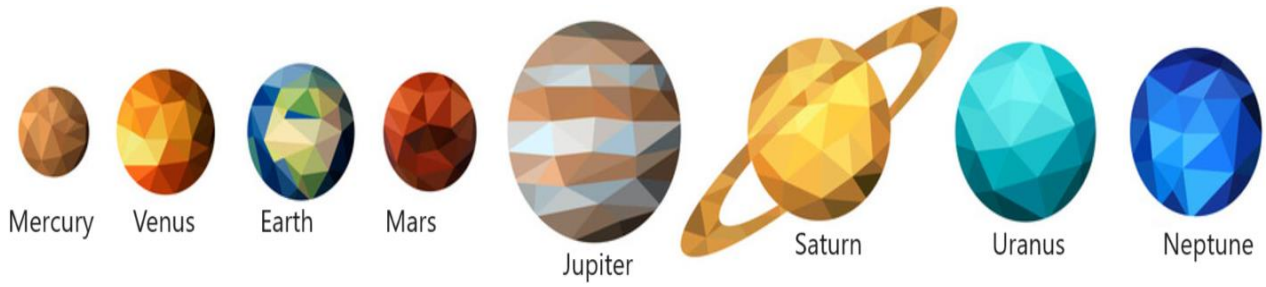
Observing the Solar system

A. Download sky view app or sky view and observatory to find some of the planets at night.

B. Just point the app at the object in space at night to enjoy beautiful sights.

SOLAR SYSTEM

Earth's position in the Solar System



(a) Earth's oxygen, suitable temperatures, and water make it perfect for life.

(b) The average temperature on Earth is about 23°C, with the highest recorded temperatures being 70°C in Iran and 68°C in Queensland, Australia.

(c) Organisms can live, grow, and feed in good conditions.

(d) Algae are the base of aquatic and land food chains and produce 70% of the oxygen we breathe.

(e) The Amazon rainforest in Brazil has over 41,000 plant and animal species, while Kruger National Park has over 800 species.

Answer the following questions:

1. Mention the conditions that make the planet Earth suitable for life.

   _____

2. What is the average temperature on the planet Earth?

   _____

3. What are the highest temperatures on record and where were they recorded?

   _____

4. Discuss the role played by algae plants.

   _____

5. Discuss interesting facts about the Amazon, Kruger National Park and other ecosystems that you know of or have researched about.

   _____

   _____

   _____

   _____

THE MILKY WAY GALAXY

(a) Our Solar System is located near the edge of the Milky Way Galaxy.

(b) The Milky Way is made up of stars held together by gravity.

(c) The Milky Way is a flat disk with billions of stars, described by the ancient Greeks as "spilled milk."

(d) It has a spiral shape with many arms.

(e) A galaxy is a large group of stars held together by gravity, ranging from 10 million to 1 trillion stars.

(f) The Sun is in the Orion arm, about halfway from the center of the Milky Way.

Answer the following questions:

Low – Order Questions

1. Where is the Solar System located in the Milky Way?

   _____

2. What holds the stars in the Milky Way together?

   _____

3. How did the ancient Greeks describe the Milky Way?

   _____

Middle – Order Questions

4. What is the general structure of the Milky Way?

   _____

5. What is the size range of stars in a galaxy?

   _____

6. Which arm of the Milky Way contains the Sun?

_____

7. What are the key characteristics of a galaxy?

_____

8. What role does gravity play in galaxies?

_____

_____

9. How is the Milky Way different from other types of galaxies?

_____

_____

10. How does the location of our Solar System assist in observing the Milky Way?

_____

_____

High – Order Questions

11. Analyse the importance of the Sun's location in the Orion arm for Earth's conditions.

_____

_____

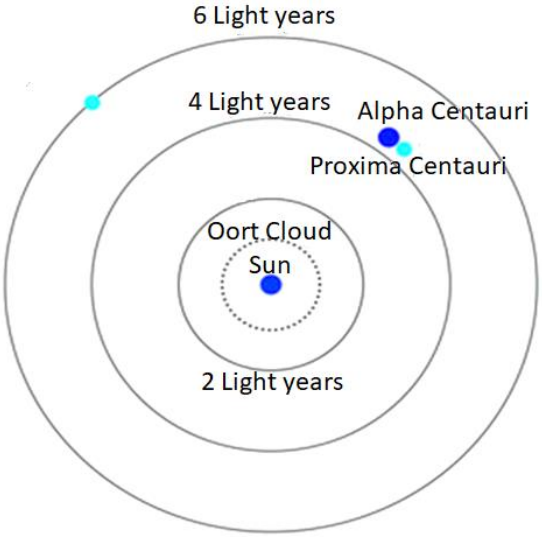
12. Discuss the significance of the spiral shape of the Milky Way in terms of star formation.

_____

_____

_____

OUR NEAREST STAR



(a) The Sun is the closest star to Earth, about 150 million kilometers away.

(b) After the Sun, the closest easily visible star is Alpha Centauri in the Southern Cross.

(c) Alpha Centauri is part of a three-star system, with the main stars Centauri A (bigger and hotter) and Centauri B (smaller and cooler).

(d) The second closest star is Proxima Centauri, about 4.24 light years away.

Answer the following questions:

1. What is the closest star to the Earth?

   _____

2. What are the two closest stars after the Sun?

   _____

3. Describe the structure of Alpha Centauri.

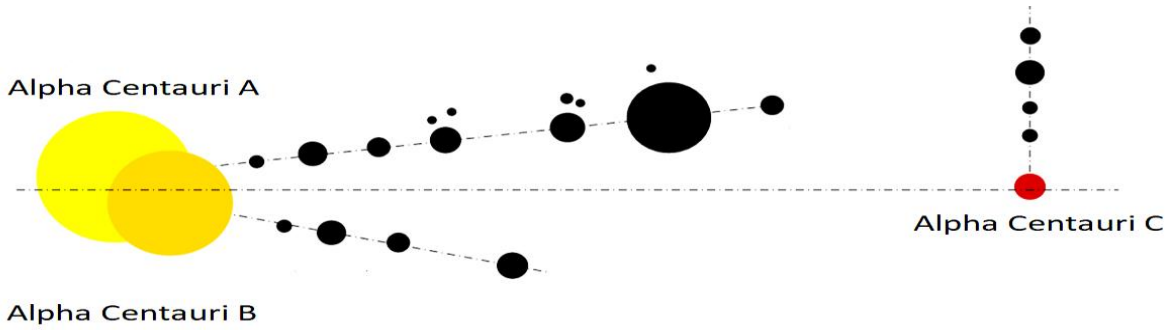
   _____

   _____

4. How far is the star Proxima Centauri?

   _____

Light years, light hours and light minutes



(a) A light year is defined as the distance travelled by light in a period of one year.

(b) Light years are used to measure the distance between objects in the universe.

(c) **Light year** = 60 (**seconds in a minute**) x 60 (**minutes in an hour**) x 24 (**hours in a day**) x 365.25 (**days in a year**) x 300 000 km /s (speed of light in a second).

(d) A light hour is a distance travelled in one hour, maybe a light day and a light month.

(e) Our planet Earth is 8 light minutes from the Sun. (Light minute = 60 x 8 x 300 000)

(f) The closest star to the Sun is known as Alpha Centaury (triple star) which is about 4.2 light years.

(g) The Solar System's diameter is estimated at 13 light hours (9,09 billion kilometres).

Answer the following questions:

1. What is a light year?

   _____

2. Calculate the light year.

   _____

3. Discuss the difference between a light month and a light minute.

   _____

   _____

4. How far is the Earth from the Sun in light years?

   _____

5. What is the diameter of the Solar system?

   _____

Beyond The Milky Way Galaxy

(a) There are billions of galaxies across the Universe.

(b) The Universe is a combination of all galaxies which includes planets.

(c) A galaxy is simply a cluster of stars, gas, asteroids, dust and the black hole.

(d) A galaxy ranges from about 10 million (10,000,000) to as many as many as 1 trillion (1,000,000,000,000) stars with various shapes.

(e) The Milky Way Galaxy has a spiral shape.

(f) The size of the observable Universe is about 28 billion light years.

Answer the following questions:

1. How many galaxies are there?

   _____

2. Describe what a galaxy is.

   _____

3. What is the shape of the Milky Way Galaxy?

   _____

4. What is the size of the observable universe?

   _____

5. Discuss the difference between a galaxy and a universe.

   _____

EARLY VIEWING OF SPACE

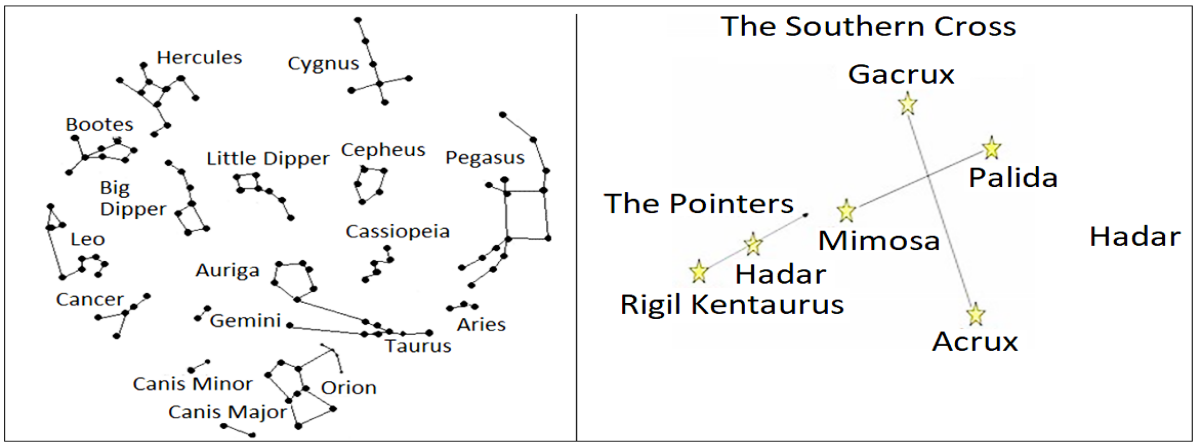
(a) Stars and some planets can be seen at night.

(b) Stars twinkle whereas planets do not.

(c) Planets like Mercury, Mars, Jupiter and Saturn can be seen without a telescope.

(d) Best dates to see Mars: 19th of January 2025 and 19 February 2027.

(e) Mercury is difficult to see because it is too close to the Sun and light from the Sun interferes with its sight.



(f) The viewing of stars was reported during the birth of Jesus Christ.

(g) Some men came from the East. They are astrologers—men who study the position of stars, claiming that by doing so they are able to tell the meaning of events in people's lives.

(h) People have read stories about stars and have used stars to read seasons apart, e.g. the rain season

(i) Some stars form constellations with stories linked to them.

(j) A constellation is an observable pattern formed by the stars.

Answer the following questions:

1. At what time of the day do we see stars?

   _____

2. Which planets can be seen without the use of a telescope?

   _____

3. Which days are best for seeing the planet Mars without a telescope?

   _____

4. Discuss what make is it difficult to see Mercury.

_____

5. Which people used stars to find the birth of Jesus Christ?

_____

6. What is a constellation?

_____

7. Share a story about constellations learned from your community.

_____

_____

_____

TELESCOPES

(a) Telescopes are used to study objects in the universe.

(b) The greatest mathematician named Galileo Galilee was the first to use a telescope to study planets and their moons.

(c) Galileo did not invent a telescope but it was invented by the eye glass maker Hans Lippershey of Holland.

(d) Looking into space requires cloudless skies with limited light and less air pollution.

(e) Some telescopes use light (optical telescope) whereas some use radio waves (radio telescope).

(f) The telescope used to take pictures in space was launched in 1990 and is known as The Hubble Telescope.

(g) The James Webb Telescope launched on the 25th of December 2021 is the largest and most powerful space telescope ever built with an ultraviolet camera to can see through clouds and dust.

Refractor Telescope

Radio Telescope

Hubble Telescope

Answer the following questions:

1. What is the use of telescopes?

   _____

2. Who invented the first telescope?

   _____

3. How did the scientist use the telescope?

   _____

4. When was the Hubble Telescope launched?

   _____

5. What makes the James Webb Telescope different?

   _____

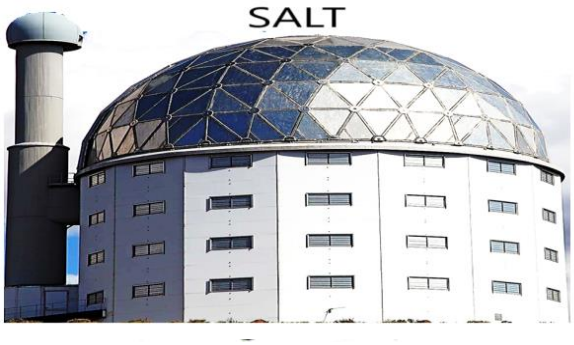
RADIO AND OPTICAL TELESCOPES

A. Refracting and reflecting telescopes are optical telescopes that use lenses to gather light light.

B. Radio telescopes gather radio waves to collect information.

C. Space telescopes are in space and can see much more than Earth-bound telescopes since they do not have interference.

D. The SKA, the most ambitious and complex scientific projects ever, will be the world's largest radio telescope, to explore the universe, address fundamental questions in astrophysics, including the origins of galaxies, dark matter, cosmic magnetic fields and the possibility of life elsewhere.



E. SALT's design is based on the **Hobby – Eberly Telescope** located in Texas, USA with a primary mirror fixed at a 37-degree angle, and relying on a moving tracker that adjusts to the movement of celestial objects such as stars, galaxies and other distant objects across the sky.

Optical Telescope **Southern Africa Large Telescope (SALT)**	**Radio Telescope** **Square Kilometer Array (SKA)**
• Located near Sutherland in South Africa's Karoo. • Amongst the largest in the world. • It was started in 2004. • Helped astronomers to discover the first white Dwarf pulsar.	• To be built in South Africa and Australia. • In South Africa it will be built at Carnarvon, a town in the Karoo (Cape Town). • Will have processing power of almost a million computers to study stars, galaxies and to detect life elsewhere.

Use the table to answer some of the questions that follow:

1. What are the two main types of optical telescopes?

_____

2. How do refracting telescopes differ from reflecting telescopes in their method of gathering light?

_____

_____

3. What type of waves do radio telescopes collect to gather information?

_____

4. Why are space telescopes able to see more than Earth-based telescopes?

_____

5. What is the full form of SKA, and what will it be used for?

_____

6. Where is the Southern African Large Telescope (SALT) located, and when was it built?

_____

7. What astronomical discovery was made using SALT?

_____

8. What are the two countries where the SKA will be built?

_____

9. In South Africa, where exactly will the SKA be built?

_____

10. What is the estimated computing power of the SKA, and why is it necessary?

_____

11. On which telescope is the design of SALT based?

_____

12. How is the primary mirror of SALT positioned, and why is this design important?

_____

13. What kind of scientific questions will the SKA explore?

_____

14. What is one major difference between optical telescopes and radio telescopes in terms of what they observe?

_____

_____

15. Why is it significant that the SKA will have such a large array of radio antennas?

_____

_____