Role of Moon in the Development of Life on Earth

Why in news?

Moon, the only natural satellite of Earth played vital role in the geology of Earth and evolution of life.

What is the Earth's Moon and how did it form?

- **Moon -** It is the Earth's most constant companion, which orbits at a mean distance of about 384,400 km.
- **Tidal locking-** The Earth and Moon are tidally locked. Their rotations are so in sync we only see one side of the Moon.
- Humans didn't see the lunar far side until a Soviet spacecraft flew past in 1959.
- **Features-** The Moon has a solid, rocky surface cratered and pitted from impacts by asteroids, meteorites and comets.
- **Size-** It is approximately 1***/4th the size*** of Earth in terms of diameter.
- In surface area, the Moon covers about *1/16th of Earth's total surface area* and it roughly has *1.2% of Earth's mass.*
- The moon's gravitational force is only about ***16.6 % of Earth's gravity*** which means a person would weigh 6 times less on the moon than they do on Earth.
- Moon takes 27 days to revolve around Earth, its lunar cycle is 29.5 days (i.e., from one new moon to other new moon)

- **Formation of Moon -** Moon was formed when a Mars-sized object ***(Theia)*** smashed into the Earth about *4.5 billion years ago.*
- This enormous collision spun out a *cloud of debris* that evolved into the moon.
- As per research, Theia came from outer solar system that collided with the Earth.

Lunar Eclipse
The lunar eclipse of the Moon is caused by Earth which completely blocks the direct Sun rays which reach the Moon, with the only light reflected from the lunar surface being refracted by Earth's atmosphere. **Types** • **Total lunar eclipse-** It occurs when the Moon and Sun are on opposite sides of Earth. • **Partial lunar eclipse-** It happens when only part of Earth's shadow covers the Moon.

What is the role of Moon in the development of life on Earth?

- **Effect of tides on evolution -** Tides resulting from the gravitational force of the moon affect *animal life in the intertidal zone* (where the ocean meets the land between high and low tides).

- Big tidal ranges have been responsible for forcing bony fish into shallow pools on land, prompting the *evolution of weight-bearing limbs and air-breathing organs.*
- The tides eroded the coastal areas, *adding minerals to the oceans* an essential element for life to evolve quickly.
- **Effect of lunar cycle on reproduction-** The reproductive cycles of many marine creatures are *closely synchronised* with lunar phases.
    - **Example** - The mass spawning of corals on the Great Barrier Reef is triggered by the Moon.
- Nocturnal animals behave differently depending on where the moon is in the sky during lunar phase.

- There is also a link of *lunar rhythms with human behaviour*, activity and even fertility.
- Some scholars arguing that human reproductive behaviour was originally synchronous with the moon, but got modified recently by modern lifestyles.
- **Impact on climate change**- Moon's gravitational pull helps *transport heat away from equator* to the poles, shaping earth's climate.
- The absence of moon would lead to extreme climate change as there would be huge differences between temperatures and daylight throughout the year.
- Moon also *stabilises the Earth's rotation on its axis* by slowing Earth's rotation on its axis.
- **Impact of Moon's light-** The ability to see and to be seen enhances in the moonlight.
- Studies have documented changes in the *success rates of predators and foraging patterns of prey animals* due to this added night time illumination.
    - Studies have shown that lions are less likely to hunt during the full moon and lion attacks on humans happen 10 days after the full moon.
- **Water distribution-** It is with the formation of the Moon, water came to Earth for the first time in 4.4 billion years ago.
- *Theia's collision with Earth* led to the formation of moon provided sufficient *carbonaceous material* to account for the entire amount of water on Earth.
- **Tectonic plates**- The *moon's pull of gravity* might have set the Earth's tectonic plates.
- It raises the level of the world's oceans towards the equator.

What about the recent lunar missions?

Only three other countries have achieved the soft-landing on the moon's surface the United States, Russia and China.

What is the need for exploring the Moon?

- **Scientific Knowledge-** To pursue scientific activities that address fundamental questions about the history of Earth, the solar system and the universe.

- **Human Settlement**- To extend human presence to the moon to enable eventual settlement.
- **Test Bed** - To test the technologies, systems, flight operations and exploration

techniques to reduce the risks and increase the productivity of future missions to Mars and beyond.

- **Economic Expansion-** To expand Earth's economic sphere, and conduct lunar activities with benefits to life on the home planet.
- **Water Exploration –** To utilise the remnants of water in the shaded spots would remain a permanently frozen mixture of dust and ice.
- **Mineral Exploration -** To tap the billions of dollars of untapped mineral resource that the moon holds.
- **Public Engagement-** To use a vibrant space exploration program to engage the public and help develop high-tech workforce to address the challenges of tomorrow.
- **Global Partnerships-** To provide a challenging, shared and peaceful activity that unites nations in pursuit of common objectives.

References

1. Down to Earth| Evolution of Moon
2. ISRO| Chandrayaan 3 launch
3. Indian Express| 3rd mission to Moon

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