Mains Practice Question

Q. What are the unique features of James Webb telescope which makes it superior to its predecessor Space Telescopes? What are the key goals of this mission? What potential benefits does it hold for the human race? (250 words)

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Approach

- Introduce in brief about James Webb telescope.
- Discuss its superiority over predecessor telescopes.
- Elaborate James Webb's key goals and potential benefits to humans.
- Conclude accordingly.

Introduction

- James Webb telescope is the result of an international collaboration between NASA, the **European Space Agency (ESA)** and the Canadian Space Agency which was launched in December 2021.
- It is currently at a point in space known as the **Sun-Earth L2 Lagrange point,** approximately 1.5 million km beyond Earth's orbit around the Sun.
- It's the largest, most powerful infrared space telescope ever built.
- It's the **successor to Hubble Telescope.**
- Its advanced equipment can look backwards in time to just after the Big Bang (birth of universe) by looking for distant galaxies that are so far away that the light has taken many billions of years to get from those galaxies to our telescopes.

Body

- **Special Features of James Webb:**
  - The JWST will **observe primarily in the infrared range** and provide coverage from 0.6 to 28 microns.
  - The instruments on its predecessor **Hubble telescope see mainly in the ultraviolet and visible part of the spectrum.** It could observe only a small range in the infrared from 0.8 to 2.5 microns.
    - Whereas, Webb's primary mirror has a **diameter of 6.5 metres while** Hubble's mirror was much **smaller – 2.4 metres in diameter.**
- **Key goals of the James Webb telescope:**
  - It will **examine every phase of cosmic history:** from the Big Bang to the formation of galaxies, stars, and planets to the evolution of our own Solar System.
  - The goals for the Webb can be grouped into four themes.
    - The first is to **look back around 13.5 billion years** to see the first stars and galaxies forming out of the darkness of the early universe.
    - Second, to compare the faintest, earliest galaxies to today's grand spirals and understand how galaxies assemble over billions of years.
    - Third, to see where stars and planetary systems are being born.
    - Fourth, to observe the atmospheres of extrasolar planets (beyond our solar system), and perhaps find the building blocks of life elsewhere in the universe.

- **Potential benefits to humans:**
    - It will **reveal new and unexpected discoveries**, and help humanity understand the origins of the universe and our place in it.
    - The telescope will study the atmospheres of a **wide diversity of exoplanets.**
    - It will **also search for atmospheres like Earth's,** and for the signatures of key substances such as methane, water, oxygen, carbon dioxide, and complex organic molecules, in hopes of finding the building blocks of life.

Conclusion

James Webb's state of the art instruments make it ideal to search for evidence of potentially life-supporting atmospheres around many of the newly documented exoplanets and to observe worlds of Mars and Saturn's icy moon Titan, thus, making it open a whole new world of information about the universe and will bring about a revolution in the astronomical world.