Science & Technology · GS - III

Question: “Space missions involving the collection and return of extraterrestrial samples can significantly advance our understanding of the Solar System.” Discuss with reference to Japan’s MMX mission.

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 19/10/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
10	~150 words

Answer Hint

1. **Planetary science, Phobos, Deimos, sample-return technology, Solar System formation, international scientific cooperation, space exploration, technological challenges.**

Model Answer

Introduction

Space exploration enables scientists to study the origin, composition and evolution of celestial bodies. Japan’s Martian Moons eXploration (MMX) mission is an important initiative in planetary science.

Main Body

1. Objectives of the MMX Mission

Led by JAXA, the mission aims to explore Phobos, one of Mars’ two natural moons, and return samples to Earth for detailed scientific analysis.

2. Scientific Significance

1. Understanding Origins: Samples may help determine whether Phobos formed from debris generated by an impact on Mars or was captured from the asteroid population.
2. Solar System Evolution: Studying the moons can provide insights into the formation and evolution of planetary systems.
3. Technological Advancement: Sample collection, autonomous navigation and spacecraft operations can strengthen advanced space capabilities.
4. Scientific Cooperation: Such missions can expand international collaboration in planetary research.

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3. Challenges

Landing on a small moon, collecting uncontaminated samples, operating in a low-gravity environment and safely returning material to Earth pose major technical challenges.

Conclusion

The MMX mission demonstrates how sample-return missions can improve scientific knowledge and advance space technology. Its findings may deepen our understanding of Mars and the early Solar System.

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