Science & Technology · GS - III

“Sample-return missions represent an important advancement in planetary exploration and our understanding of the Solar System.” Discuss the scientific significance of Japan’s MMX mission and examine the broader importance of international planetary exploration.

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 16/10/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
10	~150 words

Answer Hint

Sample-return technology, origin of Martian moons, Solar System formation, Mars evolution, laboratory analysis, planetary science, Space technology development, international cooperation, scientific innovation, technological spin-offs, future exploration missions

Model Answer

Introduction

Planetary exploration helps scientists understand the formation and evolution of the Solar System. Japan’s Martian Moons eXploration (MMX) mission, developed by JAXA, aims to study Phobos and return samples from its surface to Earth.

Scientific Significance

1. Understanding Origins: Analysis of Phobos samples may help determine whether the moon formed from material associated with Mars or was captured from elsewhere in the Solar System.

2. Technological Advancement: The mission requires precise navigation, robotic surface operations, sample collection and Earth-return capabilities, advancing planetary exploration technology.

3. Understanding Mars: Studying Phobos and Deimos can provide insights into the evolution of the Martian system and improve scientific understanding of planetary bodies.

Broader Importance

Sample-return missions allow researchers to use advanced Earth-based laboratories to examine materials in greater detail than many spacecraft instruments permit. Such missions also promote international scientific cooperation and technological innovation. However, high costs, operational risks and sample-contamination concerns require careful planning.

Conclusion

The MMX mission demonstrates how advanced space exploration can expand scientific knowledge and strengthen technological capabilities, paving the way for future planetary missions.

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