Science & Technology · GS - III

What are asteroids? How real is the threat of them causing extinction of life? What strategies have been developed to prevent such a catastrophe?

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
15	~250 words

Answer Hint

Asteroids, Near-Earth Objects, planetary defence, mass extinction, impact probability, asteroid detection, DART, kinetic impactor, international cooperation

Model Answer

Introduction

Asteroids are rocky or metallic remnants of the early Solar System that primarily orbit the Sun. A small fraction cross or approach Earth's orbit and are classified as **Near-Earth Objects (NEOs)** when they come sufficiently close to Earth's orbital region.

Body

1. Extinction Threat

A sufficiently large asteroid impact can release enormous amounts of energy, generating blast waves, earthquakes, tsunamis and widespread fires. Dust and aerosols injected into the atmosphere could reduce sunlight and trigger prolonged climatic disruption.

The Chicxulub impact is strongly associated with the mass extinction that eliminated non-avian dinosaurs about 66 million years ago. However, an extinction-level impact is extremely rare. The practical concern is therefore continuous detection and preparedness rather than assuming an imminent catastrophe.

2. Planetary-Defence Strategies

Early detection: Ground- and space-based telescopes track potentially hazardous objects and refine their orbits.

Kinetic impactor: A spacecraft can collide with an asteroid to alter its velocity and therefore its future trajectory. NASA's DART mission demonstrated asteroid-deflection technology.

Gravity tractor: A spacecraft could remain near an asteroid and gradually alter its trajectory through gravitational attraction.

Nuclear option: For very large or short-warning objects, nuclear devices have been studied as a last-resort deflection or disruption mechanism.

International coordination: Organisations and space agencies share observations, impact assessments and response capabilities.

Conclusion

Asteroid impacts capable of global extinction are rare but potentially catastrophic. Early detection combined with tested deflection technologies and international coordination provides the most rational planetary-defence strategy.

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