Science & Technology · GS - III

“Reliability in space-launch systems depends not merely on technological innovation but also on rigorous testing, failure analysis and institutional learning.” Discuss with reference to India's launch-vehicle programme.

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 13/11/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
10	~150 words

Answer Hint

Launch-vehicle reliability, PSLV architecture, PS3 solid propulsion, failure analysis, ground qualification tests, systems integration, quality assurance, technological self-reliance, ISRO's institutional learning.

Model Answer

Introduction

India's space programme depends on reliable launch vehicles for satellite deployment and strategic missions. The PSLV has played a major role in strengthening India's independent access to space.

Importance of Testing and Failure Analysis

Launch vehicles involve complex interactions between propulsion, structures, avionics and guidance systems. Failures can result from component defects, integration problems or unexpected operating conditions.

Ground testing of the PSLV's PS3 solid-propellant stage following reported mission failures illustrates the importance of validating design improvements before subsequent flights.

Key Measures to Improve Reliability

- **Failure analysis:** Identify root causes through systematic investigation rather than treating failures as isolated events.
- **Ground qualification:** Test propulsion, structural strength, thermal behaviour and performance under simulated conditions.
- **Systems integration:** Validate compatibility between stages, avionics, guidance and separation mechanisms.
- **Quality assurance:** Strengthen component-level inspection, redundancy and manufacturing standards.
- **Institutional learning:** Incorporate lessons from unsuccessful missions into future designs and operational procedures.

Conclusion

A successful stage-level test is an important milestone, but complete mission reliability requires integrated validation and flight-proven performance. Continuous testing and institutional learning will strengthen India's space ambitions.

BECOME IAS
AI POWERED UPSC PREP