Science & Technology · GS - III

Discuss the potential of artificial intelligence in accelerating semiconductor materials discovery. Examine its significance for India's technological self-reliance and the challenges involved.

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 20/10/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
10	~150 words

Answer Hint

AI-driven research, material-property prediction, semiconductor ecosystem, R&D investment, chip manufacturing, technological self-reliance, skilled workforce, intellectual property, research infrastructure.

Model Answer

Introduction

Semiconductors underpin modern electronics, telecommunications, artificial intelligence and strategic technologies. Artificial intelligence can accelerate materials research by identifying promising candidates and predicting their properties before extensive laboratory testing.

Potential of AI

1. **Faster discovery:** Machine-learning models can screen large datasets and narrow the search for materials with desirable electrical, thermal and structural properties.

2. **Lower research costs:** AI-guided experiments can improve research efficiency by prioritising promising candidates.

3. **Better chip performance:** New materials may support more energy-efficient, faster and specialised electronic devices.

Significance for India

AI-driven materials research can strengthen domestic semiconductor capabilities, reduce technological dependence and encourage collaboration among universities, startups and industry. It can complement India's efforts to develop chip design, fabrication, packaging and research ecosystems.

Challenges and Way Forward

High computing costs, limited high-quality datasets, shortages of specialised researchers and the difficulty of scaling laboratory discoveries into manufacturing remain important barriers. India should invest in research infrastructure, skilled talent, industry–academia partnerships and reliable experimental validation.

Conclusion

AI can transform semiconductor research, but technological self-reliance requires sustained investment across the entire innovation and manufacturing chain.

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