Science & Technology · GS - III

Examine the opportunities and challenges associated with the entry of Indian chemical companies into the semiconductor supply chain. How can India strengthen its domestic ecosystem for semiconductor-grade materials?

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
10	~150 words

Answer Hint

Electronic-grade chemicals, ultra-high purity, semiconductor fabrication, supply-chain resilience, capital expenditure, customer qualification, R&D, technology transfer, domestic manufacturing.

Model Answer

Introduction

Semiconductor manufacturing depends not only on fabrication equipment and chips but also on specialised materials such as ultra-high-purity chemicals, gases and photoresists. This creates opportunities for India's chemical industry.

Opportunities

- Rising semiconductor investments can increase demand for electronic-grade materials.
- Domestic suppliers can reduce import dependence and strengthen supply-chain resilience.
- Technological upgrading can improve industrial capabilities and generate skilled employment.

Challenges

- Semiconductor-grade chemicals require extremely high purity and consistent quality.
- Developing manufacturing facilities involves substantial capital expenditure.
- Long testing and customer-approval cycles delay commercialisation.
- Dependence on advanced technology and specialised inputs creates additional risks.

Way Forward

India should promote industry-academia collaboration, advanced R&D, technology partnerships and specialised testing facilities. Policy support should encourage domestic manufacturing while ensuring quality standards. Companies must demonstrate commercial production capability and establish reliable customer partnerships.

Conclusion

Developing a domestic semiconductor-materials ecosystem can strengthen India's technological and economic security, provided investment is supported by sustained innovation and quality assurance.

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