How does the rate of sand extraction for glass production impact local ecosystems and biodiversity?

Phenomenon:

Rapid sand extraction can lead to significant environmental degradation.

Inquiry Focus:

Investigate the ecological consequences of sand mining on local wildlife, vegetation, and water resources, and explore sustainable extraction practices.

What are the potential alternatives to natural sand in glass making, and how sustainable are they?

Phenomenon:

The depletion of natural sand resources prompts the search for alternatives.

Inquiry Focus:

Explore materials like recycled glass, manufactured sand, or other industrial by-products as substitutes for natural sand in glassmaking, and assess their environmental and economic sustainability.

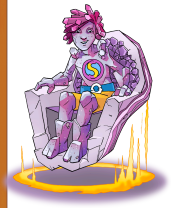
How does the carbon footprint of glass production from raw sand compare to that of producing glass from recycled materials?

Phenomenon:

Glass can be made from both raw sand and recycled glass, but their environmental impacts differ.

Inquiry Focus:

Calculate and compare the carbon emissions associated with producing glass from raw sand versus recycling existing glass, and discuss the implications for reducing greenhouse gas emissions.



What are the long-term environmental impacts of sand mining on coastal and riverine environments?

Phenomenon:

Sand mining alters coastal and riverine landscapes over time.

Inquiry Focus:

Research the long-term effects of sand mining on erosion, water quality, and sediment transport in coastal and river ecosystems, and propose measures to minimise these impacts.

. In what ways can the glass industry reduce its reliance on virgin sand resources to become more sustainable?

Phenomenon:

The glass industry is heavily dependent on natural sand resources.

Inquiry Focus:

Investigate strategies for reducing the glass industry's reliance on virgin sand, such as increased recycling, the use of alternative raw materials, or improvements in manufacturing efficiency.

How does the life cycle of a glass product—from production to disposal—affect its overall sustainability?

Phenomenon:

The sustainability of glass products depends on their entire life cycle.

Inquiry Focus:

Conduct a life cycle assessment (LCA) of a glass product, considering factors like raw material extraction, manufacturing, usage, recycling, and disposal, to evaluate its overall environmental impact.

What role do government regulations and policies play in promoting sustainable sand mining and glass production?

Phenomenon:

Government policies can influence the sustainability of natural resource extraction.

Inquiry Focus:

Analyse existing regulations and policies related to sand mining and glass production, and explore how they can be improved to promote sustainability and protect ecosystems.

How can the principles of a circular economy be applied to the glass industry to enhance its sustainability?

Phenomenon:

The circular economy aims to minimize waste and make the most of resources.

Inquiry Focus:

Investigate how the glass industry can adopt circular economy practices, such as recycling, reusing, and remanufacturing glass products, to reduce its environmental impact and resource consumption.

What are the social and economic consequences of unsustainable sand mining on local communities?

Phenomenon:

Unsustainable sand mining can have significant social and economic impacts.

Inquiry Focus:

Research how communities are affected by sand mining, including issues related to displacement, loss of livelihoods, and conflicts, and propose solutions that balance economic needs with environmental protection.

How can technological innovations in glass production contribute to more sustainable practices?

Phenomenon:

Advances in technology have the potential to make glass production more sustainable.

Inquiry Focus:

Explore recent technological innovations in glass production, such as energy-efficient manufacturing processes, the use of alternative fuels, or advances in recycling techniques, and evaluate their potential to improve sustainability.