

OCEAN ENGINEERING

WITH DR ANUSCHEH NAWAZ

Talking points

KNOWLEDGE

1. What shape is the cross-section of a carbon nanotube?
2. What does SCUID stand for?
3. By how much does pressure increase with every 10 m of water depth?

COMPREHENSION

4. In oceanography, what are 'dead zones', and how are they created?
5. What kind of membrane does the ProOceanus instrument have?
What does this membrane allow it to do?

APPLICATION

6. If you met Anuscheh, what questions would you ask about her journey into ocean engineering?

ANALYSIS

7. What are the problems with current methods for measuring gases dissolved in seawater?
8. How are carbon nanotubes able to measure gas concentrations?
9. How does Anuscheh control the carbon nanotube gas sensors to make sure they are responding directly to N_2O ?
10. What are Anuscheh's motivations for wanting to measure N_2O specifically? Why is N_2O an important gas to measure?

EVALUATION

11. "If you want to have unusual ideas, you need to have unusual experiences!" says Anuscheh. To what extent do you agree with this statement, and why? What experiences in your life have influenced your ideas?
12. Imagine you are working on a research ship where you spend several weeks at sea collecting measurements of gases dissolved in the ocean. What do you think you would most like and dislike about the work?

Activity

1. Causes and consequences of dead zones

Design a poster or infographic to explain the causes and consequences of coastal dead zones to 11-14-year-olds. Your poster or infographic should be eye-catching, engaging and consider the following:

- What land-based human activities contribute to dead zones in the ocean?
- How do these land-based human activities cause dead zones?
- What role do natural microbial cycles play in forming dead zones?
- What are the environmental, economic and social impacts of dead zones?
- Can you display all the above information in a single interconnected diagram or graphic?

The following websites are a good place to start your research:

oceanservice.noaa.gov/hazards/hypoxia
education.nationalgeographic.org/resource/dead-zone

2. Bringing life back to dead zones

How can we restore ecosystems in dead zones? To reduce the environmental, economic and social impacts of hypoxic coastal waters, governments need to implement policies that prevent land-based human activities from contributing to dead zones. What strategies could achieve this? Write a one-page policy brief advising a government about the different approaches it could take to reducing the country's contribution to dead zones.

More resources

- Anuscheh recommends looking at the American Geophysical Union (www.agu.org) website and magazine, which is full of interesting resources showing what oceanography research is happening right now.
- Scientific and technological resources rely on collaboration between research teams with different skills and expertise. Learn more about Anuscheh's partners for SCUID: Pro-Oceanus (pro-oceanus.com) and NASA Ames Research Center (www.nasa.gov/ames).
- The National Oceanic and Atmospheric Administration (NOAA) provides educational resources for students and educators (oceanservice.noaa.gov/education), as well as videos and podcasts about different ocean-related topics, including a podcast about dead zones (oceanservice.noaa.gov/podcast/feb18/nop13-hypoxia.html)