

MATERIALS CHEMISTRY WITH DR NICOLAS BOSCHER

TALKING POINTS

KNOWLEDGE

1. What is materials chemistry?
2. What is a photocatalyst?

COMPREHENSION

3. Can you explain why most hydrogen fuels cannot be considered completely 'clean' yet?
4. What is the difference between photosynthesis and the process of photocatalytic water splitting being developed by Nicolas' team?

APPLICATION

5. Aside from not producing greenhouse gases, what are the other environmental benefits of photocatalytic water splitting compared with using fossil fuels to produce hydrogen?

ANALYSIS

6. Why does photocatalytic water splitting not produce carbon dioxide, when other processes like photosynthesis and burning fossil fuels do?

SYNTHESIS

7. What are the potential difficulties with doing materials chemistry with gas molecules? Can you think of any solutions to those problems?

EVALUATION

8. Do you think there are any downsides to using hydrogen fuels?
9. How would you assess the pros and cons of other solutions to reducing greenhouse gas emissions?

CREATIVITY

10. What environmental or other issues could materials chemistry address?

ACTIVITIES YOU CAN DO AT HOME OR IN THE CLASSROOM

Look at the areas of research covered by each member of Nicolas' team to see how varied their expertise is. Now, create your own multi-disciplinary 'research team' to tackle a global problem:

- In small groups or on your own, create a mind map that identifies causes and impacts of a global problem like climate change, giving specific examples. For example, 'using fossil fuels to power cars contributes to climate change', 'ocean acidification as a result of climate change harms marine life'.
- Choose one of these causes or impacts and list possible solutions to this aspect of the problem. For example, related to cars powered by fossil fuels: 'reduce car usage', 'develop clean alternatives to fossil fuels'. Be creative and think outside of the box!
- Choose one of these solutions and write down some overarching research questions that will help you figure out whether the solution will work and what its impacts will be – think about possible pros and cons of the solution. For example, how much power is generated by hydrogen fuel? What are the environmental impacts of producing hydrogen?
- Write down the sort of expertise you will need to be able to answer your research questions and develop your solution. For example, do you need social scientists to understand how the solution might impact people, chemists or engineers to develop new substances and technologies, or ecologists who study interactions in the natural world? This is the multi-disciplinary research team you will need to understand the problem and develop a solution.
- You can try this for other global problems, such as ocean plastic pollution.
- Bonus: pick one of the 'members' of your multi-disciplinary research team – the one that interests you the most – and research career pathways for this kind of role.

MORE RESOURCES

- You can learn more about green chemistry – chemistry that prevents pollution – and find some activities and resources from the American Chemical Society here: www.acs.org/content/acs/en/greenchemistry/students-educators/online-educational-resources.html
- Other chemistry resources and activities are provided by STEM learning: www.stem.org.uk/home-learning/secondary-chemistry