



MATERIALS SCIENCE WITH THE SUSCORD PARTNERSHIP

TALKING POINTS

KNOWLEDGE:

1. What is corrosion?
2. What is materials science?

COMPREHENSION:

3. Summarise the three principal theories for corrosion protection and to what extent each is supported by the team's research.
4. What are the differences between empirical design and rational design in research?

APPLICATION:

5. What criteria would you look for when deciding which of the team's computer models should be tested in real life?
6. What factors would you include in an environmental impact assessment of paint products?

ANALYSIS:

7. How do the researchers create 'accelerated' corrosion to shorten the effects of long timescales?
8. Why do you think high concentrations of pigments may lead to greater leaching? Think about the other ingredients in paint.

EVALUATION:

9. If private companies are funding research, it is often in their interests to keep findings confidential to give them a competitive edge. How can academic researchers reconcile this with ideals of scientific accessibility?

CREATIVITY:

10. What do you think a typical city would look like if effective methods for corrosion protection did not exist?

ACTIVITIES

1. CORROSION – A TV SPECIAL!

From rusty gates to rusty car parts, we see rust and other evidence of corrosion around us every day, but we probably give it very little thought. However, corrosion – especially at much larger, industrial scales – can be very problematic and expensive to deal with, which is why we need researchers like Stuart, Yanwen and Andrew to investigate solutions.

Can you make people see rust in a new light?

Devise a script or storyboard for a TV documentary about the issue of corrosion. Your audience will need to know:

1. What corrosion is and what causes it
2. The economic impact of corrosion
3. What can go wrong when corrosion is not treated
4. What researchers like the SusCoRD Partnership are doing to solve the problem.

In addition to the article, here are some useful websites to help inform your script:

<http://impact.nace.org/economic-impact.aspx>

www.materialstoday.com/amorphous/articles/rust-an-age-old-problem

If you can, film or present your 'show' to your class.

2. A RECORD OF CORROSION

Working in groups of two, find a pair of six metal objects from around the home or classroom (for example, a pair of coins, staples, screws, paper clips, bobby pins, nails and washers). To six cups, add water about a quarter full and add a pinch of salt to three of the cups (stirring and mixing the salt in). Drop the metal objects in the cups of water (one half of the pair in the normal water and the other in the salt-mixed cup) for a few minutes, then place them on a paper towel and observe them for a week. In your notebook, record:

1. Which of the items corroded and those that did not
2. Was there a difference in the rate of corrosion for items in the saltwater?
3. What could be used to prevent or reduce corrosion in metals?

ACTIVITIES

3. MANIPULATIVE METHODS

The team uses a vast array of different techniques to discover and manipulate the properties of substances within paint. Using the internet, research how each of these methods work, some of their uses and how you think they are applicable to the SusCoRD project.

Method	How it works	Applications	Use in the SusCoRD project
Electron microscopy			
X-ray tomography			
Atomic force microscopy			
Ellipsometry			
X-ray/neutron scattering			
Infrared microscopy			
Scanning electrochemical microscopy			

4. MATERIALS OF THE FUTURE

Think about the emerging technologies of the future. What role do you think materials scientists will (or do) play in their development? Write a few sentences for each of the technologies below. Feel free to research via the internet if you are unsure of what these ideas entail.

- | | |
|---------------------------------|--|
| a. Solar technology | d. Porous road surfaces (to minimise flooding) |
| b. High-speed rail | e. Carbon capture and storage |
| c. 3D-printed bone replacements | f. Delivery drones |

MORE RESOURCES

- More information about the SusCoRD project can be found on the University of Manchester website, including progress to date, interviews with key people and the specific aims of each of the work packages involved: www.sites.manchester.ac.uk/suscord/

- Information on painting the Forth Bridge, and general history of the Queensferry crossings across the river Forth near Edinburgh can be found at the Three Bridges website: www.thethreebridges.com/forth-rail-bridge/. Check the YouTube videos comparing the historic and modern ways of painting and maintaining the bridge.

- The ScienceDaily website provides regular updates from the world of materials science, providing accessible explanations of the latest findings: www.sciencedaily.com/news/matter_energy/materials_science/

- This animated video from FuseSchool describes how corrosion occurs and methods to combat it: www.youtube.com/watch?v=jQoE_9x37mQ