

ATMOSPHERIC CHEMISTRY

WITH DR TRAN NGUYEN

Talking points

KNOWLEDGE

- What causes acid rain?
- On average, how many breaths do humans take each day?

COMPREHENSION

- How does the atmospheric chamber help Tran study atmospheric reactions?
- How do radicals affect chemical reactions in the atmosphere?

APPLICATION

- If you observed a new chemical reaction in an atmospheric chamber, what questions would you ask to learn more about it and its effects on the Earth's atmosphere?
- How would you test whether this new chemical reaction is affected by temperature?

ANALYSIS

- Reactions involving hydroxyl radicals can have a big impact on air pollution. How is this reaction similar to the one that caused the depletion of the ozone layer?
- What are Tran's motivations for studying atmospheric reactions?

SYNTHESIS

- Atmospheric modelling can help us predict when periods of intense air pollution might occur. How would you use this information to help cities cope with extreme levels of pollution?

EVALUATION

- Atmospheric modelling can help us predict what the climate might be like in the coming decades. How useful do you think this information could be in the fight against climate change?

CREATIVITY

- Based on information from the article, how would you design a new intervention to help reduce air pollution in cities?

Activities

1. Local Clean Air Action Plan

What are the main sources of air pollution in your local area? Identify as many as you can, e.g., traffic, farms, industry. How could your area tackle air pollution through a clean air action plan? Research how pollution from each source can be reduced or mitigated, e.g., alternatives to the pollution-producing activities or technologies to remove pollutants. How could people be encouraged to change their behaviour to reduce pollution?

Create a PowerPoint presentation to propose your clean air action plan to your local authorities. You should include:

- A bit of background about the problem of air pollution
- How the problem presents itself in your local area
- Recommendations for how to reduce the problem
- Creative ideas for how to inform the people in your area of the problem and the steps they need to take to reduce it

2. Air pollution and greenhouse gas emissions

Explore the following interactive datasets, or find emission data for your country:

- Ozone and particle pollution in the US: gispub.epa.gov/airnow
- Wildfires in the US: fire.airnow.gov
- Pollution emissions in the UK: naei.beis.gov.uk/emissionsapp

Select some major pollutants, such as PM2.5 (fine particulate matter) and ozone, and consider the following:

- Where are pollutants geographically concentrated?
- Why are they concentrated in those regions?
- How does fire impact air quality and human health?
- What emissions are tracked for the purpose of monitoring air quality?

Greenhouse gases are not considered air pollutants as they don't directly affect human health. However, they drive climate change and its adverse effects on ecosystems and humans, such as severe weather and ocean acidification.

Explore global greenhouse gas emissions (www.climatewatchdata.org/ghg-emissions) and consider the following:

- Globally, where are greenhouse gas emissions highest and lowest?
- How have emissions from different countries changed over the last 30 years?
- What are the causes of the global differences and changes through time?

More resources

- The UC Davis College of Agricultural and Environmental Sciences (CAES) offers an early academic outreach programme that high school students can take part in to get practical experience of real science: eaop.ucdavis.edu
- Explore the CAES website to discover more about their research and outreach programmes: caes.ucdavis.edu/outreach
- Professor Daniel Jacob from Harvard University offers educational materials in atmospheric chemistry: acmg.seas.harvard.edu/education
- Visit Tran's Futurum webpage to watch an animation and download a PowerPoint about her work:
www.futurumcareers.com/understanding-the-atmosphere