



Understanding climate change as a process

Education in Chemistry

Sustainability in chemistry 2021

Goal 13: take urgent action to combat climate change and its impacts

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Earth's atmosphere is incredibly complex and human activities have changed its composition in ways that result in extreme changes of climate. This activity looks at the chain that leads from human action in one place to an effect on the environment in another place.

Your teacher has drawn a flow diagram showing the processes that lead to climate change.

First, answer the **short questions** below without looking at the flow chart:

1. What do 'burning fossil fuels' and 'deforestation' have in common?
2. What two things can increase the amount of atmospheric methane?
3. Why does question 2 say 'atmospheric methane' and not just 'methane'?
4. Why are greenhouse gases called greenhouse gases?
5. If we have a winter that's colder than usual, does that prove global warming isn't happening?
6. What is the difference between global warming and climate change?
7. What are the effects of changes to the distribution of rainfall?

Next, answer the **calculation questions** below:

A molecule of methane is approximately 30 times more effective as a greenhouse gas than a carbon dioxide molecule.

8. How many molecules of carbon dioxide would need to be released to have the same greenhouse effect as 5 molecules of methane?
9. How many molecules of methane are in one mole of methane?
10. What is the mass of one mole of methane?
11. What mass of carbon dioxide would need to be released to have the same greenhouse effect as 10 kg of methane?

The questions below deal with **atmospheric methane**:

12. Methane can be combusted in oxygen as below:
$$\text{CH}_4 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$$

Balance the equation.
13. A student says that combusting atmospheric methane increases the greenhouse effect because it releases carbon dioxide. Explain why the student could be wrong.
14. Over time, methane in the atmosphere breaks down. Carbon dioxide does not break down. Given this new information, explain why the student could be right.
15. What more information do you need before you can tell for sure if the student is right?

Finally, answer these **longer-response questions**:

16. Polar bears live on the ice in the Arctic Circle. Explain how rice farming in India can affect polar bears in the Arctic Circle over 4000 km away.
17. A student says, 'In order to stop climate change, all we need to do is plant more forests'. Prepare a one-minute speech stating whether you agree or disagree with the student and explaining why.