

Activity 11 – Tipping Points: When the Climate Changes...



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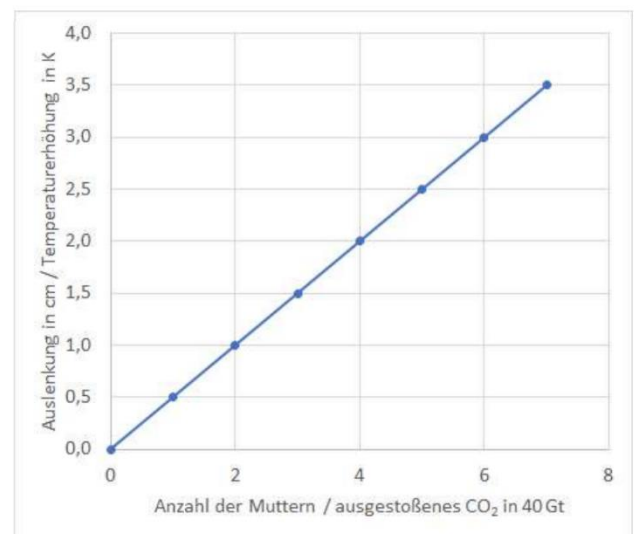
Will climate change at some point be unstoppable?

Experiment 1: Small cause, small effect

The relationship between the inserted nut and the position x of the ball is now to be examined more closely:

werden:

- Place eight nuts one after the other in the container and enter the rest position of the ball in the diagram. How far is it from the beginning rest position at the end?
Note: If you think the ball is stuck, give it a light push and let it settle down again.
- The ball is still on the left. Now take the nuts out of the container one by one (CO₂ is removed from the atmosphere) and mark the rest positions with a pen of a different colour and enter the values in the same graph.



- ? What is the mathematical relationship in this experiment taking measurement errors into account?

A linear increase in deflection with the number of nuts can be seen → direct proportionality between nuts and deflection or CO₂ emission and temperature

The devastating forest fires of 2019/20 in Australia have released about 30 Gt of CO₂. They were the result of an unusually long drought.



- ? What possibilities exist to extract CO₂ from the atmosphere?

There are natural CO₂ sinks that remove CO₂ from the atmosphere, such as forests and oceans. In addition, large amounts of greenhouse gases are trapped in the ice, e.g. under the permafrost.

Experiment 2: Small cause, big effect

We now examine the tipping point at which the system changes to another state.

- Guess, without trying, from which position the ball will roll to the other side and how many nuts this corresponds to.

It is estimated that the system could perhaps tip at 12 nuts (480Gt CO₂).

- Check your assumption in the experiment. Gradually put nuts into the container until the air conditioning system tilts.
- Now remove the added CO₂ from the Earth's atmosphere again (remove nuts from the bag).
- Answer the following questions for evaluation:
 - ? Where is the actual tipping point compared to your estimated one?

In fact, the system already tilts at 10 nuts (400Gt CO₂).

- ? Does the drastic rise in temperature decrease when the added CO₂ is removed from the atmosphere?

Once the system has moved to its new state, it does not return, even if all the nuts are removed again. The process was irreversible, so it cannot be reversed. Similarly, there are some tipping points in the climate system that cannot be reversed once they have been crossed!