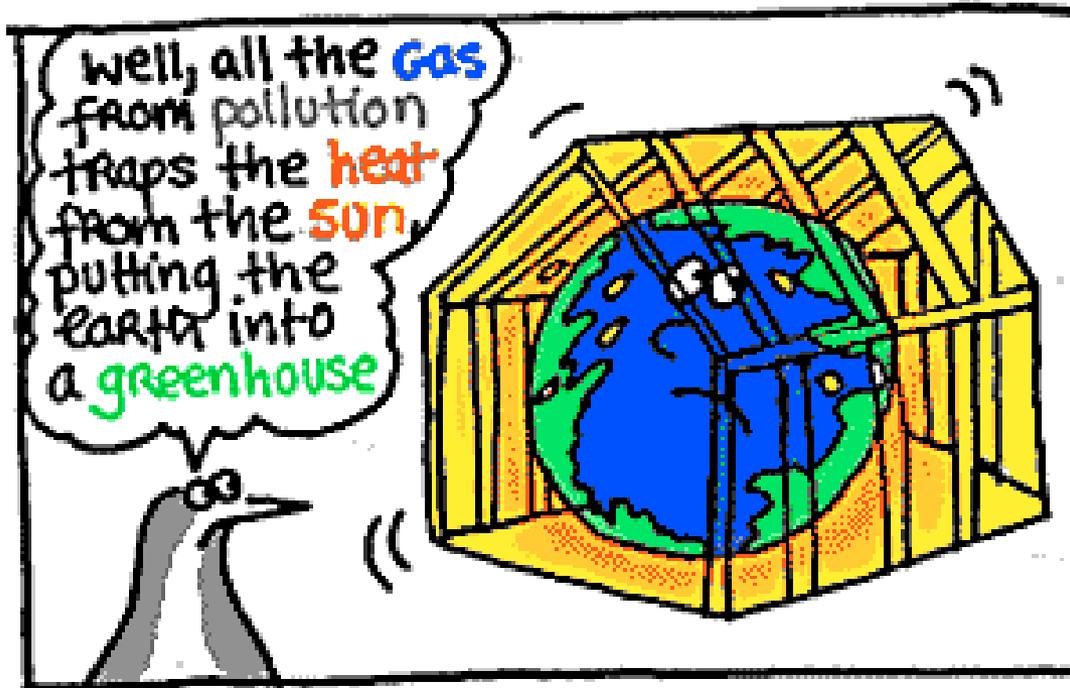


The Use of Models and Analogies for Teaching Science



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Introduction

- “Models and analogies might be thought of as types of metaphors used to help explain science concepts that maybe hard to imagine because they involve things that are very large (e.g. solar system) or very small (e.g. cells), processes (e.g. photosynthesis) or abstract ideas (e.g. energy)” Advice to teachers - National Strategies DfES 2004
- Students were encouraged to think about how models and modelling worked, as well as the science concepts they helped explain

Uses of models in teaching

- Scientific models – e.g the particle models of solids, liquids and gases.
- Teaching models – e.g. pupils linking themselves together, moving differently etc.
- Analogies – give more meaning to pupils by comparing with everyday objects and phenomena.

See also DfES 2004 – KS3 Science National Strategy

Benefits of using models in teaching

- It can help students' understanding the science
- The model gives them the language to be able to discuss the science explanation.
- Models can be memorable.

Use of the greenhouse model

So the greenhouse effect is like a greenhouse when you walk in, it's warm isn't it, 'cause the heat is trapped inside.. It's almost like the same as a greenhouse

Year 8 School A

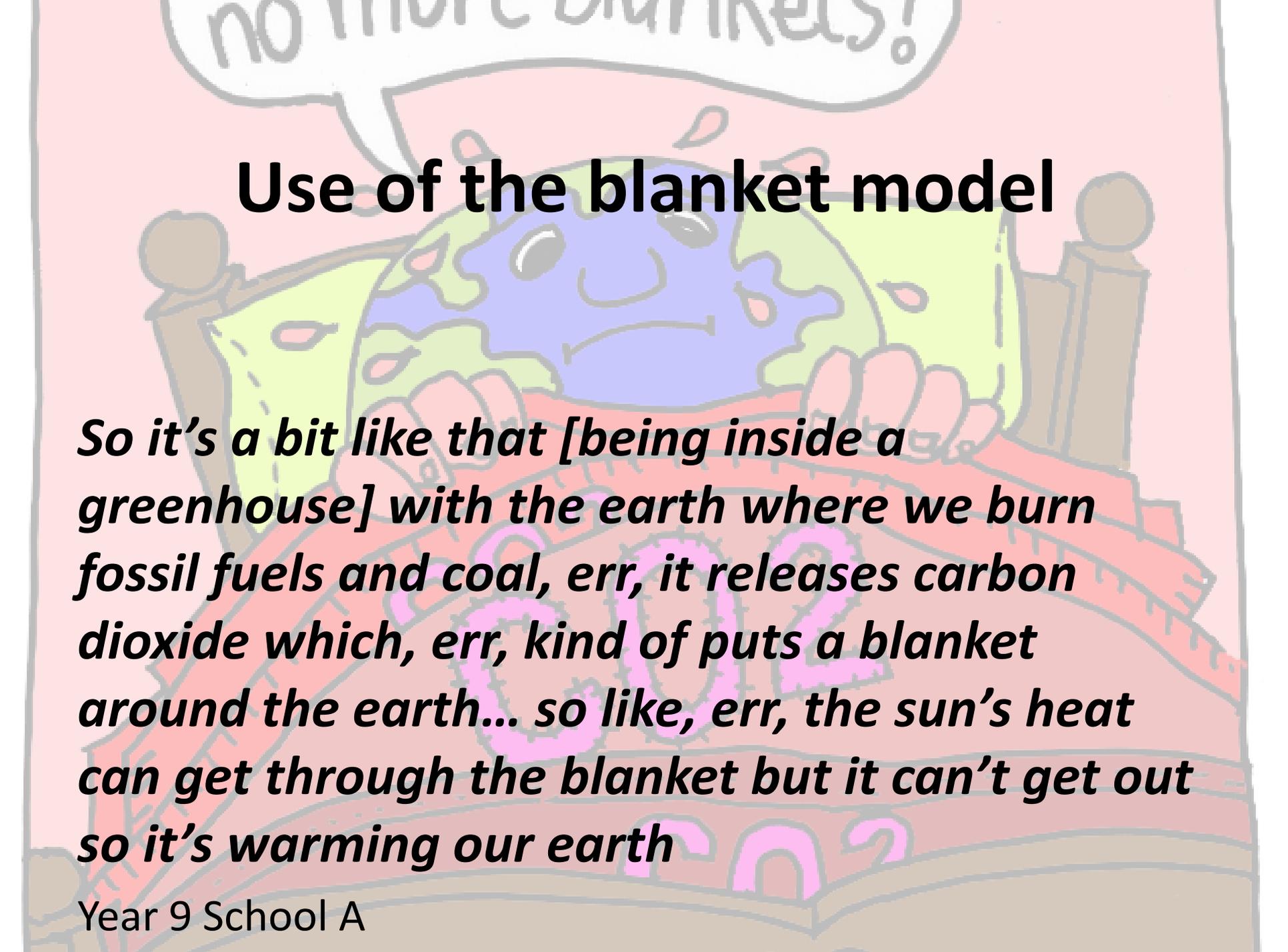


Student A: It's just like a greenhouse innit?

It gets really hot inside 'cause of all the glass and it's like these gases are doing that in the atmosphere.

Student B: Yeah, well that's why it's called the greenhouse effect. It's bloody bad!

Year 11 School C

A cartoon illustration showing a globe of the Earth with a sad face, wrapped in a red blanket. Two figures are holding the blanket. A speech bubble above the globe says "no more blankets!". The background is a light pink color with faint outlines of buildings and a sun.

Use of the blanket model

So it's a bit like that [being inside a greenhouse] with the earth where we burn fossil fuels and coal, err, it releases carbon dioxide which, err, kind of puts a blanket around the earth... so like, err, the sun's heat can get through the blanket but it can't get out so it's warming our earth

Potential drawbacks of using models

- Model or metaphor can be taken too literally.
- If the model fails to relate to their every day experience then it may simply confuse.
- Analogy/model may lead to confusing misconception

Problematic..?

*My Mum has a greenhouse so I kind of, like, refer back to that... the sun is able to get into, like, the glass and then when it's inside it can't get out... and it's like the earth is covered in lots of, like, glass panels **but we just can't see them**, because the sun's projecting into them. It doesn't, it won't come out, it'll just keep coming in and when it tries to get out, **it'll just bounce off the roof** and down in a continuous loop*

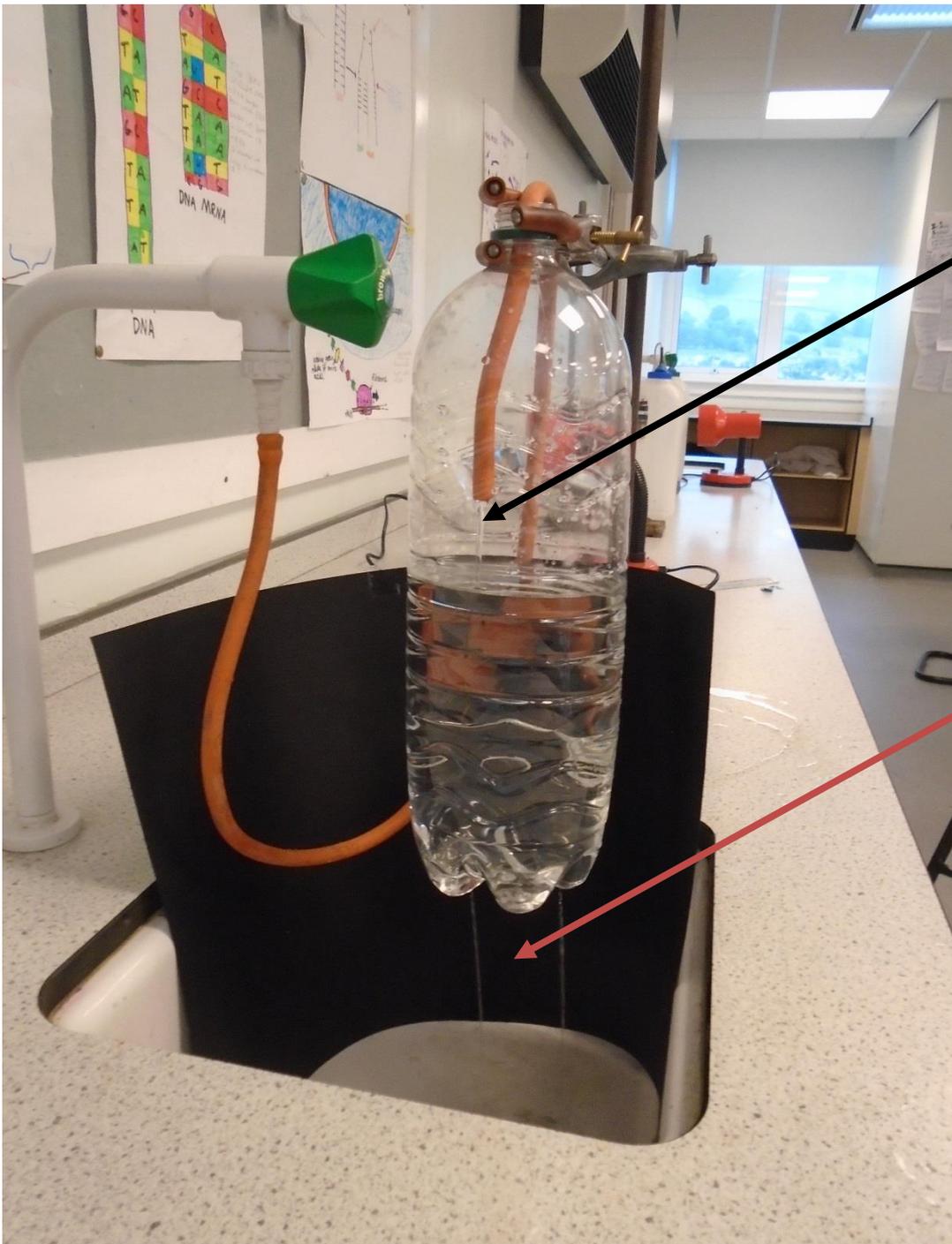
Year 8 School A

*The earth is almost becoming stuffy because we're running out of clean air and warmth from the sun because the blanket of greenhouse gases **is not allowing anything out or anything in***

Year 7 School C

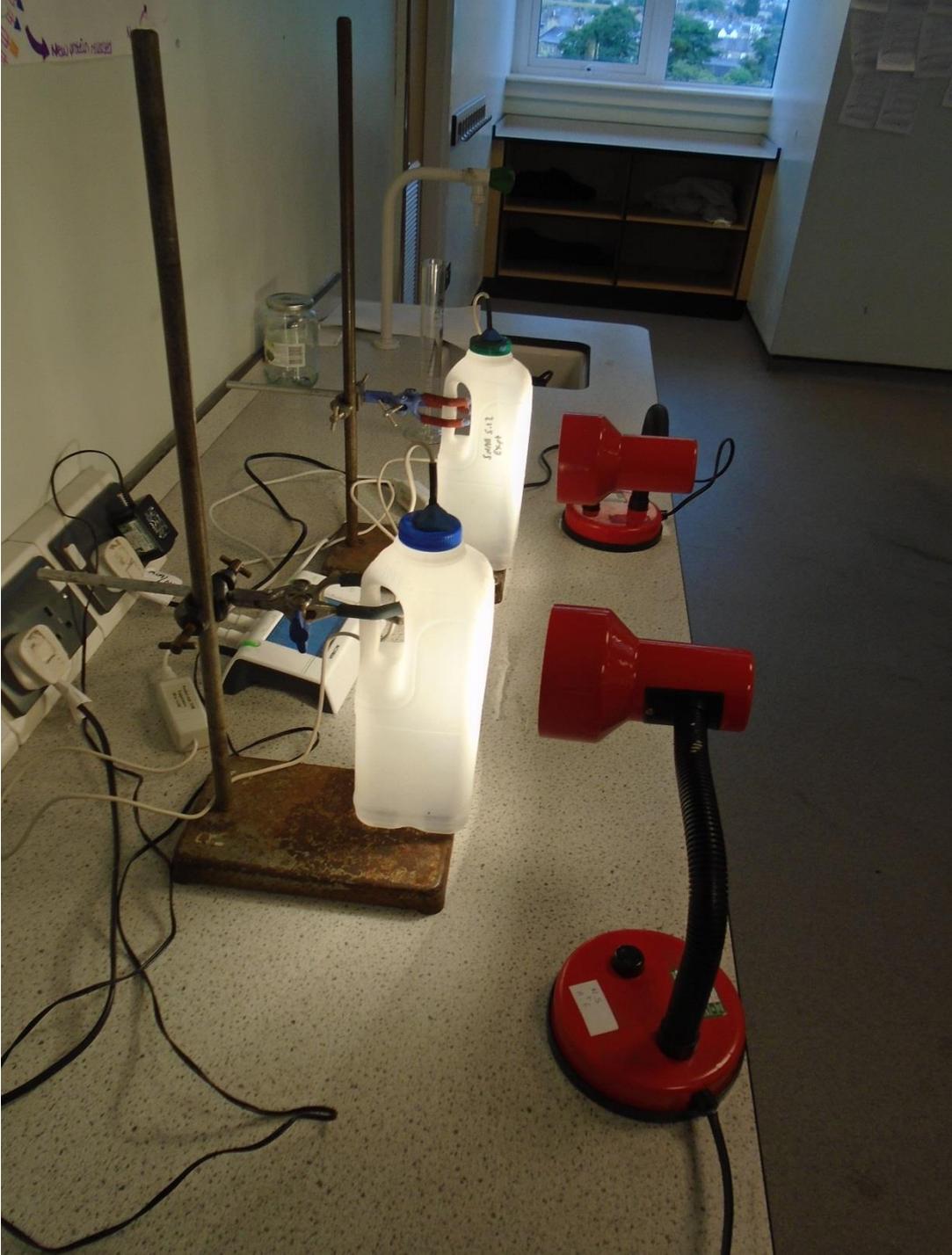
Models used in teaching climate change?

- A key idea is global warming is due to an imbalance between the energy arriving and the energy leaving the Earth
- What happens to the Earth's temperature
 - If energy in equals energy out?
 - If energy in is greater than energy out?
 - If energy in is less than energy out?



Water from tap
trickles into the
bottle

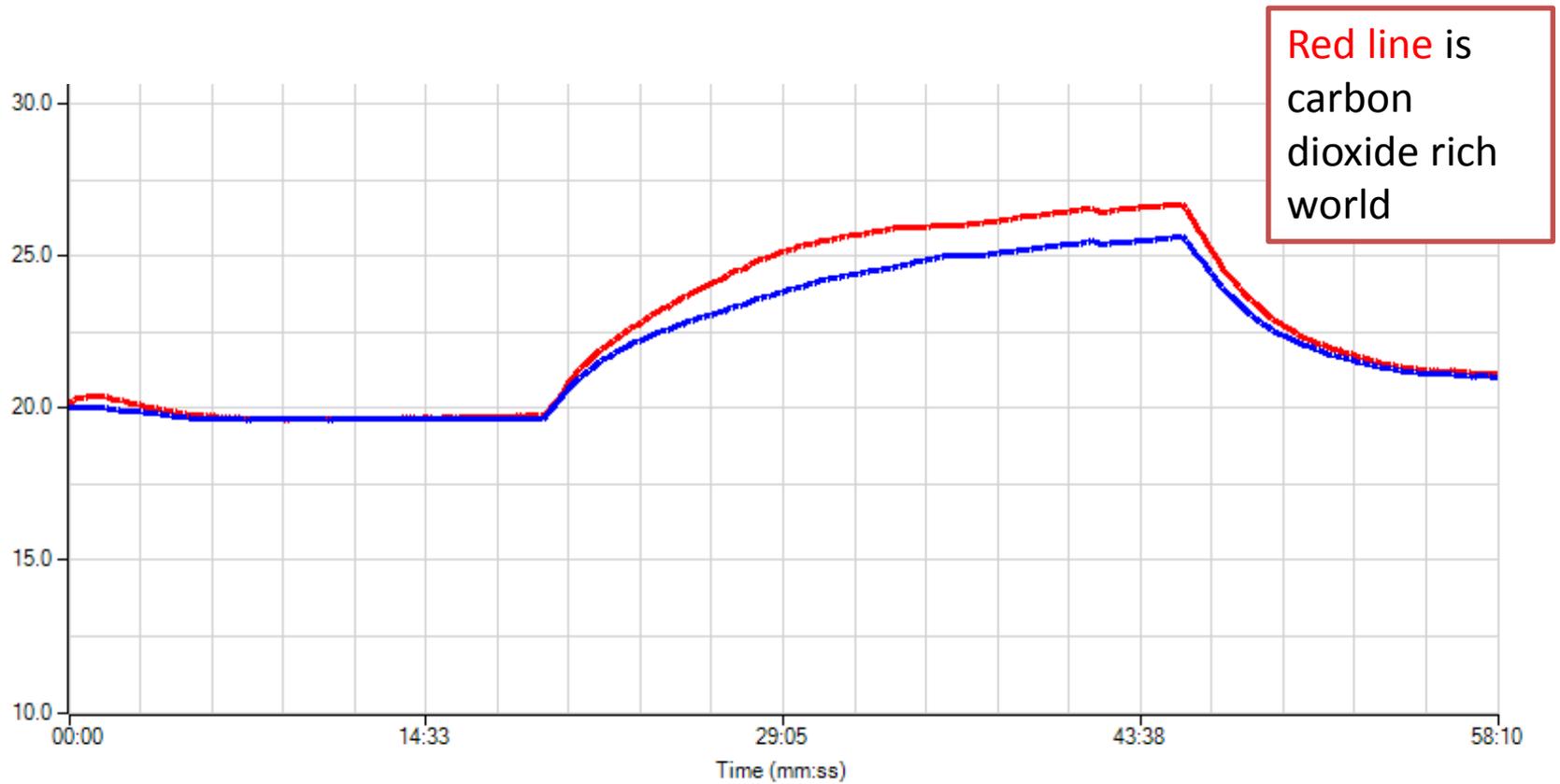
Holes in the
base of the
bottle leak
water



Two worlds both with equivalent Suns but one with a carbon dioxide enriched atmosphere

What happens to the temperatures of our worlds over a lesson?

Greenhouse Effect Model Data



Final thoughts

- Important to think about how we use metaphors, analogies and models in teaching and learning
- Appraising the model itself can aid conceptual understanding – and check for it
- Particularly important here when despite years of teaching about this students still get confused about greenhouses, blankets, the ozone layer etc