

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE**

**A333/02/INS**

**PHYSICS A**

Unit 3: Ideas in Context plus P7 (Higher Tier)

**INSERT**

**Wednesday 9 June 2010  
Afternoon**

**Duration: 60 minutes**



**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- This insert contains the article required to answer question 1.

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## Climate ‘fix’ could deplete ozone

### Research has cast new doubt on the wisdom of using sulfate particles to cool the planet.

Sulfate injection is an example of a geo-engineering solution to climate change being discussed by scientists.

Data published in the journal ‘Science’ suggests that sulfate injection would lead to drastic thinning of the ozone layer.

This would delay the recovery of the Antarctic ozone hole by decades, and cause significant ozone loss over the Arctic, say US researchers.

Sulfate injection is carried out by pumping sulfate particles which reflect sunlight into the upper atmosphere to counteract global warming. This idea comes from nature.

Major volcanic eruptions emit vast quantities of sulfur-containing compounds that can cool the planet significantly. Evidence for this was observed following the 1991 volcanic eruption of Mount Pinatubo.

One potential drawback is that sulfates provide a surface on which chlorine gases in polar clouds can become activated. This causes chemical reactions that lead to the destruction of ozone molecules.

### Ozone loss

Dr Simone Tilmes of the National Center for Atmospheric Research in Boulder, Colorado, and colleagues used a combination of measurements and computer simulations to estimate future ozone loss if sulfate injections were carried out.

Quantities of sulfate capable of reducing climate change would destroy as much as three-quarters of the ozone layer over the Arctic, if carried out in the next few decades, they said.

This would also delay the expected recovery of the ozone layer over the Antarctic by about 30 to 70 years, they concluded.

Ozone depletion was increased in the Antarctic after the eruption of Mt Pinatubo.

Dr Tilmes said more research was needed before society attempted global geo-engineering solutions in the future.

However, she said the study should not rule out the approach altogether.

She told BBC News: “Politicians have to decide what is most important – if you have climate change you might have catastrophic conditions – they might decide to do this anyway.

“If you have to make decisions you need to know what is good about it and what is bad about it.”



Polar stratospheric clouds provide a surface for ozone-destroying reactions.

**“The bad side is definitely the ozone depletion”**

Dr Simone Tilmes



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