

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

A333/01/INS

PHYSICS A

Unit 3: Ideas in Context plus P7 (Foundation 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.

INFORMATION FOR CANDIDATES

- This document consists of 4 pages. Any blank pages are indicated.

INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

- Do not send this insert for marking; it should be retained in the centre or destroyed.

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

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.