
THINKING SKILLS

Paper 4 Applied Reasoning

9694/41

May/June 2018

1 hour 30 minutes

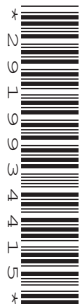
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

An answer booklet is provided inside this question paper. You should follow the instructions on the front cover of the answer booklet. If you need additional answer paper ask the invigilator for a continuation booklet.

Answer **all** the questions.

The number of marks is given in brackets [] at the end of each question.



This document consists of **7** printed pages, **1** blank page and **1** Insert.

- 1 Study the information below and answer the question that follows.

Valentine's Day is bad for romance

In some countries, Valentine's Day, 14 February, is a day of love and romance.

A newsfeed on a popular social media network reported that, on 15 February this year, the day after Valentine's Day, more than 300 000 people changed their status from 'in a relationship' to 'single' – a new record. This shows that the pressure put on couples to make Valentine's Day special has a negative effect on their relationship, and could be contributing to the high divorce rate in the population.

Make **five** criticisms of the statistics used in the passage or any inference drawn from them. [5]

Questions 2, 3 and 4 refer to Documents 1 to 5.

- 2 Briefly analyse Skeptik's argument in Document 1: *Nothing but hot air?*, by identifying its main conclusion, intermediate conclusions and any counter-assertions. [6]
- 3 Give a critical evaluation of the strength of Skeptik's argument in Document 1: *Nothing but hot air?*, by identifying and explaining any flaws, implicit assumptions and other weaknesses. [9]
- 4 'We should be worried about global climate change.'

Construct a reasoned argument to support **or** challenge this claim, commenting critically on some or all of Documents 1 to 5 and introducing ideas of your own. [30]

DOCUMENT 1**Nothing but hot air?**

I am sick and tired of hearing about all this global warming nonsense. Admittedly, we've had a couple of mild winters recently, which could be taken as evidence that the world is becoming warmer. But global temperature varies every year, so if you wait long enough, you are sure to get a few mild years in a row.

In the same way that a single year has seasons where the temperature varies, the whole planet seems to have something analogous to seasons, with runs of hotter years and cooler years. In fact, the Earth's temperature becoming warmer or cooler is a cycle that repeats every 30 years or so. Until the 1970s some scientists thought we were slipping into another ice age. Ice ages come every 10000 years and we are about due for another. Between 1970 and 2000 the Earth got warmer and it has been getting cooler since then. Global warming is just a global summer for a few years.

Anyway, there is no evidence that it is caused by humans. When the dinosaurs walked the Earth the temperatures were much higher than they are today, and there were no humans driving cars to cause global warming then.

Just because CO₂ levels and global temperatures have been increasing over the last 50 years, it does not follow that the CO₂ has caused the temperature increase. Correlation does not imply causation. We could just as easily say that the warmer temperatures have released dissolved CO₂ from the sea, or that CO₂ has caused the increase in human population. On Mars the atmosphere is 95% CO₂ and it is freezing there!

Many scientists say that humans are not the cause of global warming. I have even heard one professor say it was caused by cows farting. Scientists once said that the Earth was flat, so why should I take any notice of what they are saying about global warming? I read a report about some scientists who falsified their data to support the theory that global warming is caused by human activity. I don't think we can look to science for the answer to the world's problems.

Many of those who promote the global warming myth have a vested interest. Al Gore wanted to make a name for himself after he lost the US presidential election in 2000. The scientists who support the idea of global warming are just hoping for a Nobel Prize and the admiration of their peers, while the tree-huggers just want us all to wear sandals and walk everywhere.

There is no scientific proof that global warming is happening and, even if it is, we are not the cause of it.

Skeptik

DOCUMENT 2

Sea level rise bigger than feared

Sea levels are set to rise more than twice as much as previous estimates, according to a new Antarctic assessment, the results of which are published in the prestigious scientific journal, *Nature*.

The study says that melting ice could add an extra 1.14 metres (on top of previous estimates) to sea levels by 2100. The authors of the study say that cutting CO₂ emissions now could limit this risk.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) predicted that sea levels would rise by 0.98m by the end of the century but it seems this figure underestimated the contribution from Antarctica. More recent analyses have projected bigger increases, notably one suggesting a rise of 1.31 m by 2100.

There has been disagreement about the contribution of Antarctica to these estimates. As recently as 2015 a paper suggested Antarctic contributions of up to a metre were implausible. But this new study refutes the 2015 conclusion and adds another 0.73m – nearly 2½ feet!

The scientists say that their new study uses a model that is able to provide a more accurate prediction because it incorporates the impacts of a wider range of processes for the first time. Traditional models have focused on the impact of warmer water melting the sea ice. However, this new study also factors in the effects of atmospheric warming, surface melt-water, rain and whether the remaining walls of sea ice can support their own weight. “The other models didn’t include the atmospheric warming because it hasn’t started to happen yet,” said the study’s author Dr David Pollard from Penn State University, US.

The authors believe their model is accurate because they have been able to use it to replicate sea-level rises millions of years ago during warm periods of prehistory. “Existing models could not simulate enough ice-sheet melting to explain [the 10 to 20 metre rises in the past].” said Dr Pollard.

If the CO₂ emissions continue as usual over the coming decades, the scientists claim that sea-level rise will be twice what has been estimated for the next 100 years.

Other scientists have praised the development of the new model for including physical factors such as meltwater and ice-cliff collapse, but they are uncertain about the conclusions. “I have no doubt that warming will make these processes significant in Antarctica and drive a very significant contribution to sea-level rise,” commented Prof David Vaughan of the British Antarctic Survey. “The big question is, how soon could this all begin, and could it be early enough to drive substantially higher sea levels by 2100? I’m not sure, but these guys are definitely asking the right questions.”

The “good news” is, the authors believe, that if global CO₂ emissions are greatly reduced, then the extra impact of this Antarctic melting will be avoided. Seas will continue to rise, but not at the enormous rate suggested in this study.

Newspaper report

DOCUMENT 3

Scientists are getting it wrong

Scientists and broadcasters are misleading the public about climate change. Scientists' attempts to be precise and broadcasters' desire to appear fair give the false impression that there is a real debate. Climate scientists are 95% certain that humans are the main cause of the world's current global warming. But this level of accuracy has been manipulated by politically-motivated climate-change sceptics.

The way we communicate science does a disservice to the public. If you are constantly worrying about what your head of department or your PhD supervisor thinks, then you start being scientifically precise. It is just this precision that broadcasters and the general public interpret as uncertainty. Scientists *could* say with total confidence that "Climate science is uncontroversial and the current predictions for warming are the best advice available," but they don't, in case one tiny part of their statement could ever be questioned by a pedantic colleague.

The scientific view at the time is the best view that we can possibly have. It is absolutely the best advice. But this is never stated by the media. This is primarily because of the media's obsession with balance – if a mathematician published a proof that $2 + 2 = 4$, the BBC would attempt to find a crackpot mathematician somewhere that wasn't quite convinced. Sadly, it is also, even in the 21st century, partly because most media executives do not have a background in science and do not really understand that science does not take sides, it only follows the evidence.

95% certainty in science is effectively total. When they switched on the Large Hadron Collider the media reported the views of some who said it was going to "Cause a black hole and destroy the world" – well of course it wasn't! Climate change is obviously and clearly true to all of us who look at the real scientific debate that does exist about the magnitude and consequences of the undebatable current global warming problem caused by humans.

Climate-change deniers have exploited the misconception that there is doubt about global warming in order to promote a political agenda. It is permissible, if foolish, for a politician or oil company executive to say "Well I think we should do nothing". But what you should not be allowed to do is to state that there is a better estimate of the direction and causes of climate change than the one that comes from science. It is ridiculous to say "We know better": you can't know better!

To challenge the science of climate change is dangerous because it promotes the idea that science is political and can be questioned by non-scientists. This weakens the position of science with a credulous public and, because of this, with governments around the world. It is as if facts have become controversial, and that is worrying.

To undermine the science just because you are worried about the economics is a very dangerous path to tread. The big picture is, of course, that you are not just undermining that piece of science, you are undermining the only rational basis for decision-making in society.

Speech given to scientific society by world-renowned physicist

DOCUMENT 4

Variation in average temperature of Earth

Graph A

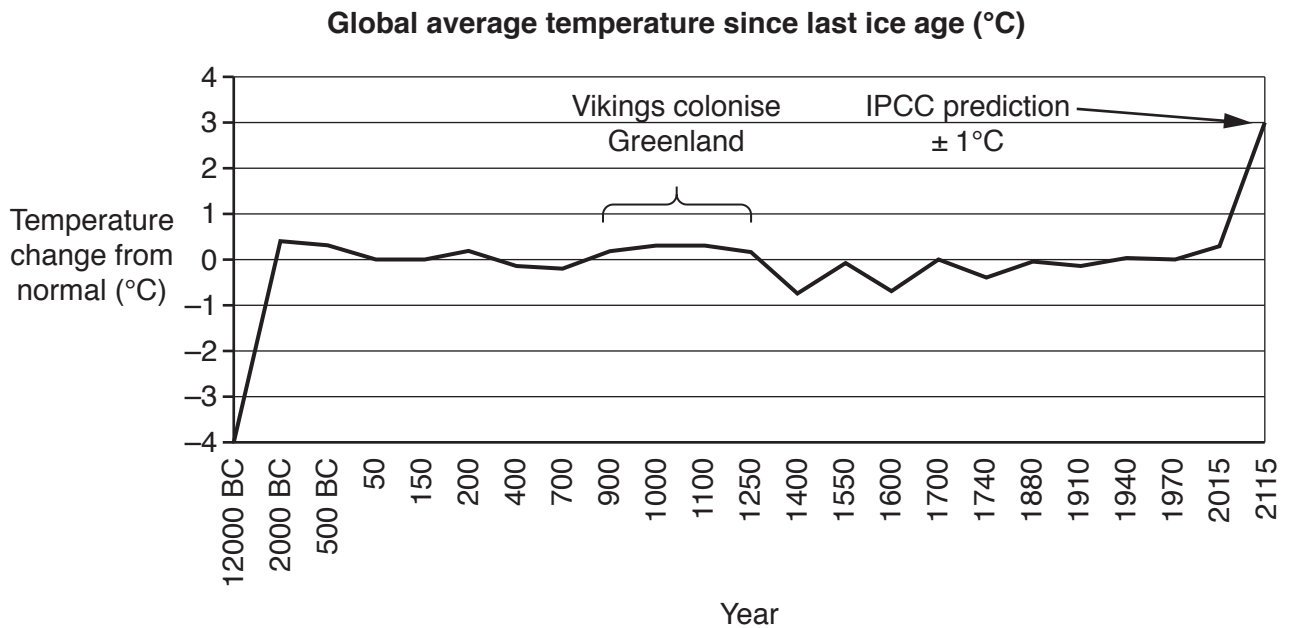


Table A

Temperature and CO₂ between 2002 and 2008

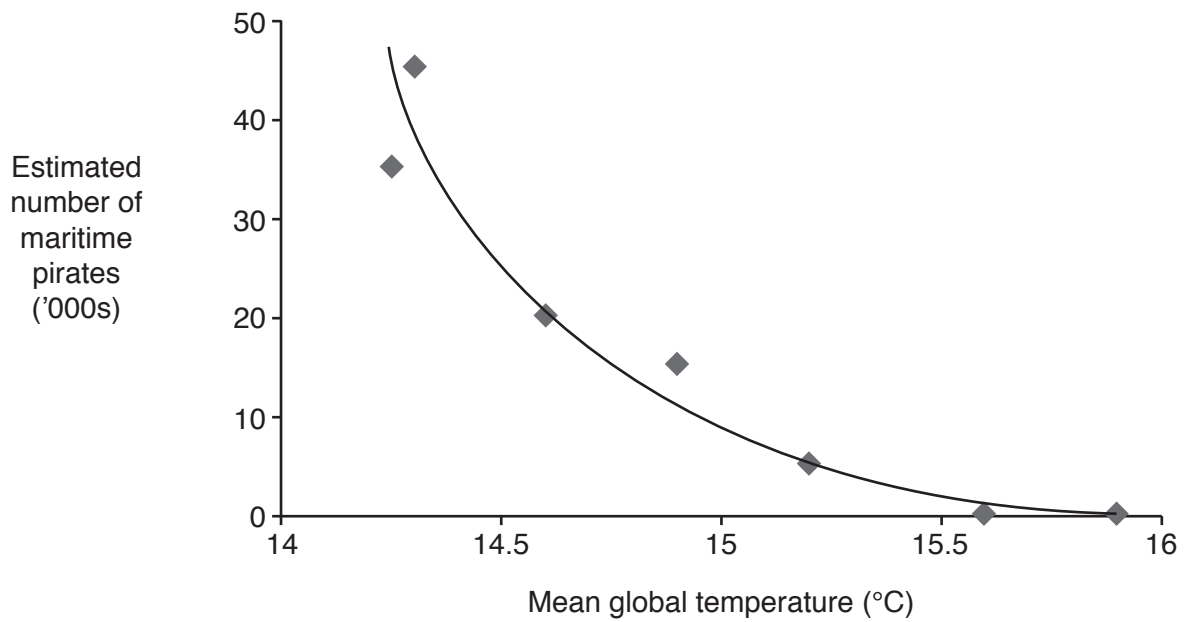
Year	Atmospheric CO ₂ (parts per million)	Global temperature difference from normal* (°C)
2002	373	0.37
2003	376	0.35
2004	377	0.28
2005	380	0.32
2006	382	0.23
2007	384	0.37
2008	385	0.24

*temperatures compared with long-term average

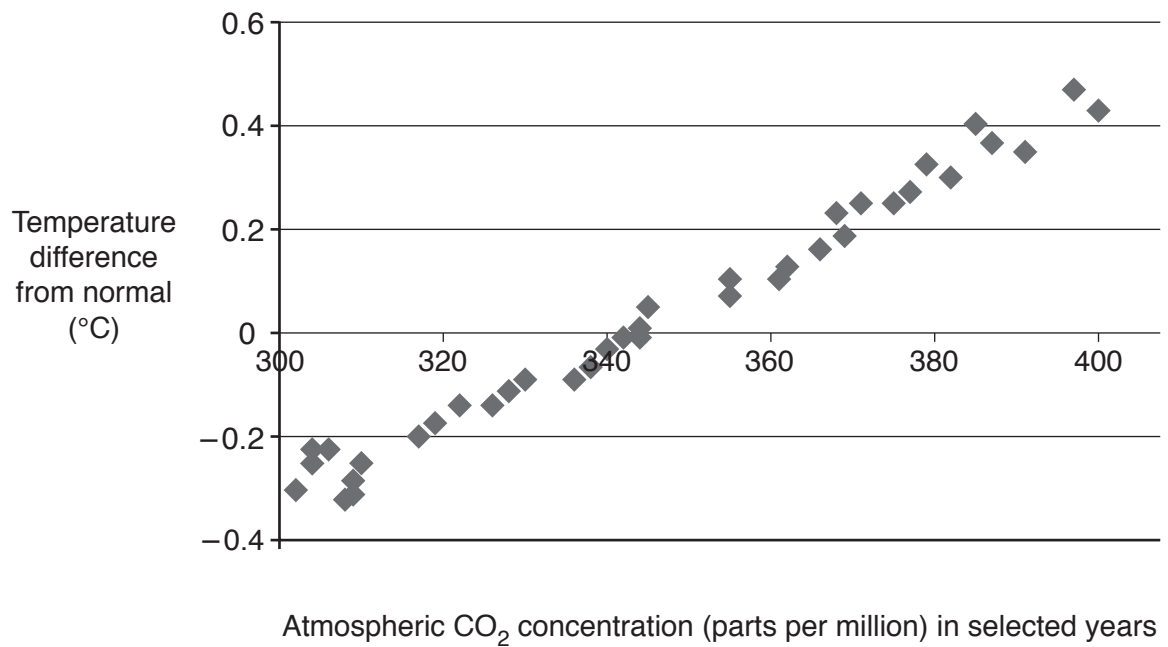
DOCUMENT 5

Some correlations with global temperature changes

Graph B



Graph C



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