



Ian Plimer's questions deconstructed.
Analysis of 'How to get expelled from school ..'
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Version 1.0

Prologue

*An elderly man at the book launch complained loudly that Australia's education system has been "captured" by the progressive left. "People ought to be worried about what their children are being taught," said the man. "It's a matter of real concern." The agitated senior citizen was later identified as former Prime Minister John Howard. From <http://theprojecttv.com.au/science-schmience.htm> promotion for segment on *The Project* broadcast on Channel 10, 13/12/11.¹*

Summary

Ian Plimer's book *How to Get Expelled from School* concludes with 101 questions that will supposedly get you expelled.

Plimer's proffered responses fall into four main groups.

- the answer agrees with mainstream science — this is the case for questions 1, 11, 17, 19, 20, 21, 28, 32, 40, 42, 74, 75, 78, 79, 84, 94 and 96 in particular;
- the question based on a false premise, false dichotomy or a straw-man construction;
- an incorrect answer is given; and/or
- no answer is given for the specific question² — just speculation about what a hypothetical 'activist teacher' might say.

Each of Plimer's questions is followed by a summary of his responses *in slant font*.

References to the scientific literature are given in Harvard (author, year) form. References to additional on-line information, especially my own analysis of *Heaven + Earth* [1], are numbered references in square brackets.

¹The broadcast had Ian Plimer saying that I couldn't possibly have read the book, and footage of me reading it.

²It is of course a subjective judgment as to whether a question is being ignored, evaded or just very poorly answered.

This document is a ‘work-in-progress’ and the history of versions is given below. The intent is that the link:

http://www.complex.org.au/tiki-download_file.php?fileId=134

will always address the most recent version of this document.

The questions

1: Is climate change normal? A: Yes.

Plimer’s answer agrees with mainstream science.

2: Is the global warming measured today unusual? A: No.

A better answer is that it is unusual, but not unprecedented — see Q11.

3: What drove climate change before humans were on Earth? *No answer is given at this point (but see question 26), just the false claim that past changes were not driven by carbon dioxide. See my response to Q26.*

4: Are we in a period of global warming? A: Yes and No.

Much of Plimer’s answer — that it depends on the time scale that you consider — agrees with mainstream science.

5: Will the 0.5° warming we experienced from 1977 to 1998 occur again? A: *We don’t know.*

Actually any answer other than ‘yes’ is inconsistent with Plimer’s claims about natural variability (as well as being inconsistent with mainstream understanding of natural variability and of course mainstream projections of anthropogenic global warming).

6: If we have dangerous warming and the global temperature has increased 0.8° since the Little Ice Age, does this mean that the ideal temperature for the Earth is that of the Little Ice Age? A: *Implies No.*

It is the rate of warming that is as ‘dangerous’ as the amount of warming, i.e. the question of whether climate change is happening faster than human and natural systems can adapt, and also the extent to which we are committed to further rapid change because of existing greenhouse gas concentrations and a commitment to energy systems that will further increase these concentrations.

7: The temperature increase between breakfast and lunch is far higher than the 0.8°C rise over the last 150 years. Why is such a small change dangerous yet larger changes each day are not? *No actual answer is given — just speculation about what a hypothetical teacher might say.*

Small differences in the long-term average temperature determine what plants (including crops) grow where, as is seen by the dependence on altitude, latitude etc. In some cases such boundaries between vegetation types are quite abrupt.

8: If global warming is human in origin, when will we feel it and when will it be dangerous?

A: This whole response is confused.

Warming in the Arctic is becoming obvious and disruptive.

9: In the last 100 years has there been global warming and global cooling? *A: Yes, both.*

For the global average this agrees with mainstream science. The main periods of cooling seem to be northern hemisphere changes. The southern hemisphere doesn't show much cooling.

10a: In the last 100 years we have had global warming alternating with global cooling on 60 year cycles.

This introduction to the substantive question is the false premise of 60 year cycles— see Q72.

10b: Which part of the global warming in the last 100 years has been driven by human actions and which is natural? *A: We don't know but human component is likely to be small.*

See analysis by Stott et al. [2001] that gives quantitative estimates of the human contribution to 20th century change.³

11: Have past climate changes been greater and quicker than modern changes? *A: Yes.*

Plimer's answer agrees with mainstream science. Examples are times around the Younger Dryas and especially any climate changes from asteroid impacts, e.g. possibly the event(s) 65 million years ago at the time that dinosaurs became extinct.

12: Does the Sun drive warmings and coolings of the Earth? *A: Yes.*

The sun is the overall driver of the climate. The various causes of **changes** in climate are listed in Q26.

13: Why is there no correlation between global warming and atmospheric carbon dioxide and yet there is correlation between solar activity and temperature? *A: Because the Sun drives surface temperatures.*

This question is based on a false premise — over the 20th century, the correlation between temperature and carbon dioxide is much greater than the correlation between temperature and solar activity.

14: Why do Mars and other planets show global warming? *A: Because of the Sun.*

This question is based on a false premise — the available evidence indicates that Mars is not warming [2].

15: If it is not the Sun driving global warming on Mars, what industries on Mars are pumping carbon dioxide into the Martian atmosphere? *A: No answer given.*

This question is based on a false premise — see Q14.

³This is cited as an example. There have been a number of additional studies.

- 16: Where does the carbon dioxide in the atmospheres of the Moon and Mars come from?**
 A: *Outgassing.*
 The moon has virtually no atmosphere, CO₂ or anything else. Mars has polar ice caps that are mostly CO₂ and as each one evaporates in the summer, the CO₂ condenses from the atmosphere at the other pole where it is winter.
- 17: Billions of years ago did the Earth's atmosphere contain carbon dioxide?** A: *Implies yes.*
 Plimer's answer agrees with mainstream science.
- 18: Where did the carbon dioxide in the Earth's atmosphere billions of years ago come from?**
 A: *Outgassing from volcanoes.*
 Plimer's answer agrees with mainstream science.
- 19: If there was a lot of carbon dioxide in the atmosphere of the early Earth, where did it go?** A: *Limestone, carbon rich sediments and life.*
 Plimer's answer agrees with mainstream science.
- 20: How much carbon dioxide does limestone contain?** A: *44%.*
 Plimer's answer agrees with mainstream science.
- 21: Where did the carbon dioxide in limestone come from?** A: *Originally from the air.*
 Plimer's answer agrees with mainstream science.
- 22: Does this mean that the air billions of years ago had more carbon dioxide than now?** A:
 Yes.
 Plimer's answer agrees with mainstream science.
- 23: If the planet originally had far more carbon dioxide in the air than now, why isn't the planet permanently very hot?** A: *Carbon dioxide does not drive climate.*
 Actually the main reason is that the sun was weaker. This is noted in, for example, Plimer's book *A Short History of Planet Earth* [5].
- 24: If carbon dioxide drives global warming, how is it that we have had six major ice ages in the past yet atmospheric carbon dioxide was far higher than now?** *No answer is given – just speculation about what a hypothetical 'activist teacher' might say.*
 Of course, the most recent of these major ice ages (beginning perhaps 2.8 million years ago) is not yet 'in the past' and the available evidence (covering the last 800,000 years) shows past carbon dioxide levels much lower than present.
- 25: Will increased atmospheric carbon dioxide increase food production?** A: Yes.
 Other things being equal, the direct effect of increased CO₂ is likely to increase the yields of some crops. Increased CO₂ can also increase the efficiency with which some plants use water, leading to increased yields if water limitation is significant. Indirect effects from climate change arising from increased CO₂ will vary greatly from place to place.

- 26: What drives climate change?** A: *..orbital, solar, terrestrial and extra-terrestrial processes...*
 Plimer's answer agrees with mainstream science — c.f. Q3. A more specific list is:
 change in solar luminosity over the life of the Sun;
 changes in solar luminosity over the course of the 11-year sunspot cycles;
 changes in the Earth's orbit;
 changes in the position of the continents, affecting such things as heat transport by ocean currents;
 emissions of aerosol particles from large volcanoes;
 emissions of aerosol particles from human activities;
 changes in greenhouse gas concentrations from human and natural causes.
- 27: Can humans change climate?** A: *No.*
 This is untrue. See Stott et al. [2001] and similar studies for estimates of how much humans have changed climate.
- 28: How much carbon dioxide is in the atmosphere at present?** A: *389 ppm.*
 Plimer's answer agrees with mainstream science, but Plimer's claim that CO₂ is non-toxic is dangerously false — see Q33.
- 29: What proportion of annual carbon dioxide emissions derives from humans and what proportion is natural?** A: *3% from human activity.*
 This is in rough agreement with mainstream science, but somewhat out of date — the 'human' proportion is now larger. However, this only applies to the direct emissions. A large part of the 'natural' emissions from the oceans are a consequence of increased ocean carbon content due to human activity. See glossary below for comments on Plimer querying the distinction between 'human' vs 'natural'.
- 30: Can you please show me how 3% of annual emissions of carbon dioxide, that is the human emissions, drive climate change and the other 97% do not.** A: *It has never been shown.*
 This question is based on a false premise — emissions don't directly cause warming – what matters is the concentrations. Natural emissions are balanced by uptake. Human emissions are only partly offset by uptake.
- 31 Why don't the variations in atmospheric carbon dioxide correlate with human emissions of carbon dioxide?** A: *Human emissions clearly have very little effect on total carbon dioxide.*
 Concentrations reflect the cumulative net emissions. Mathematically there is no reason to expect that any quantity should be correlated with its integral. For example, $\cos(t)$ and its integral $\int_0^t \cos(t') dt' = \sin(t)$ have zero correlation.
- 32: Do plants know the difference between carbon dioxide emitted from human activities and carbon dioxide from natural emissions?** A: *Of course not.*
 Plimer's answer agrees with mainstream science. However the question is irrelevant.

33: Is carbon dioxide poisonous? A: *No.*

This is dangerously false. In [1] I summarise the laboratory safety information (ChemWatch) giving the toxicity levels for CO₂.

34: Is carbon dioxide a pollutant or is it used in photosynthesis? *Plimer's answers are 'no' and 'yes', rather than 'yes' and 'yes'.*

Just because carbon dioxide is essential for photosynthesis, does not prevent it being a pollutant. For example, for humans vitamin A is an essential nutrient but it can be fatally toxic in large quantities. A false dichotomy — c.f. Q36.

35: Are atmospheric carbon dioxide levels a consequence of temperature, not the cause? A: *.. ice core data show a different story [to what a teacher might say]...*

Feedbacks mean the changes in CO₂ and temperature can each cause changes in the other. Increased CO₂ can cause warming (and has done so) — warming can cause an increase in CO₂ (and has done so). My own estimate is that about 10% of the increase in atmospheric CO₂ over the 20th century was caused by warming rather than being a direct result of CO₂ emissions. This type of feedback is particularly important in the coupling of CO₂ and climate through the course of glacial-interglacial cycles — see Q77.

36: If human body and food are composed of carbon compounds and all animals breathe out carbon dioxide, how can carbon be pollution? A: *Carbon pollution is a misleading term.*

This is based on the false premise that a natural product cannot be a pollutant. In reality waste products, e.g. CO₂ and urea, are exported (exhaled or excreted) because retaining them would be harmful to the organism that produced them. This is all largely irrelevant to the issue of climate change. Plimer's final sentence: 'Carbon is black' is even less relevant.

37: For thousands of years, prophets of doom have been telling us the world was about to end. It hasn't, otherwise we wouldn't be here. Why is it that we should believe the modern prophets of doom who tell us that carbon dioxide emissions will destroy the planet? A: *No answer is given – just speculation about what a hypothetical teacher might say.*

This question is based on a false premise — carbon dioxide will not 'destroy the planet', it will not destroy life on Earth, it will not kill off humanity.

38: If we double the amount of carbon dioxide in the air from human emissions, how much will temperature increase? A: *No answer given, but reference to fig 24..*

The amount of temperature increase due to doubling CO₂ is called the 'climate sensitivity'. The IPCC says this is 1.5 to 4.5°C. James Hansen of GISS says 2.5 to 2.5°C (excluding long-term effects of ice sheets). In *Heaven + Earth* Plimer repeatedly quotes a paper that says that a climate sensitivity of over 1.5 K has been a robust feature of the Earth's climate.

Variations on fig 24 are widely used to imply total effect of CO₂ is capped. However, over about 100 ppm, the steps are proportional to 1/*n* and $\sum_{n=1}^N (1/n)$ grows arbitrarily large as *N* increases.

The phrasing of the question is ambiguous and could mean (a) what if humans double the amount of CO₂ (from 280 ppm to 560 ppm — currently 390 ppm) or more literally (b) what if humans double the 110 ppm that is ‘from human emissions’ (going from 390 ppm to 500 ppm). The factor $\log(500/390)/\log(560/280)$ converts the ‘climate sensitivity’ (case (a)) to the answer for case (b).

39: Over the history of time, why has atmospheric carbon dioxide decreased? A: *It has gone into sediments.*

Plimer’s answer agrees with mainstream science.

40: Where has it all gone? A: *Sediments.*

Plimer’s answer agrees with mainstream science.

41: China’s carbon dioxide emissions each year rise by five times the proposed cuts to Australia’s emissions. Will Australia cutting emissions change global climate? A: *Of course not.*

China has repeatedly refused to take action without actions by developed nations (i.e. the USA). Political leaders in the USA have repeatedly cited inaction by Australia as support for inaction by the USA.

My argument in *Twisted* is that other nations (including China) are beginning to take action, and Australia is not in a position to hold out as the largest per capita emitter in the developed world in defiance of the rest of the world. Early preparation for a carbon constrained world is in Australia’s interest.

42: Is water vapour or carbon dioxide the main greenhouse gas in the atmosphere? A: *Water vapour.*

Plimer’s answer agrees with mainstream science.

43: If water vapour is the main greenhouse gas, why doesn’t the government have a tax on water vapour emissions? A: *No answer is given — just speculation about what a teacher might say.*

Because water vapour is changing in response to warming from greenhouse gases (and any other warming) — water vapour is not the primary compound forcing the change.

44: Does global warming cause drought or does drought cause global warming? A: *No specific answer given, just derogatory comments about David Karoly.*

Neither here, nor on any of the pages discussing Karoly, does Plimer give references to the papers that he claims ‘slammed’ Karoly.

Greenhouse warming will shift rainfall patterns bringing more drought to some area and more rain to others. On the other had, cold glacial periods are generally dry, due to the large amounts of water locked up in ice sheets.

45: How can you explain why it was warmer in the Medieval Warm Period than now yet there were no carbon dioxide emitting industries? A: *The Medieval Warm Period was natural.*

This question is based on a false premise — that the Medieval Warm Period (MWP) was warmer. In [1] I give an extensive analysis of the references cited by Plimer concerning past climates and show that a very large proportion of his cited references fail to support his claims.

46: If the warming in medieval times was natural, what is the evidence to show that the late 20th century warming was not natural? A: *No answer is given.*

The most important evidence is that the surface warming in the late 20th century is accompanied by stratospheric cooling, confirming the mechanism proposed by Arrhenius in 1896.

47: Since thermometer measurements were made, there has been warming from 1860 to 1880, cooling from 1880 to 1910, warming from 1910 to 1940, cooling from 1940 to 1977, warming from 1977 to 1998 and cooling from 1998 to now. Which warmings and coolings were of human origin? A: *No answer is given.*

See Stott et al. [2001], indicating solar causes dominating early 20th century warming, sulfate aerosols dominating mid-century cooling and greenhouse warming dominating thereafter. c.f. Q10.

48: Why could the Northwest passage be navigated in the 1930s and 1940s in wooden boats, yet it could not be navigated in the late 20th century warming? A: *No answer is given.*

This question is based on a false premise — the Northwest passage could be navigated in the late 20th century.

49: In 1903 Amundsen passed through Canada's Northwest passage ... If the planet is warming why is this not possible now? A: *Arctic sea ice changes on cycles of 30 and 18.6 years.*

This question is based on a false premise — the Northwest passage has been traversed (without the help of ice breakers) in 2008 and 2009. (Amundsen's passage actually took from 1903 to 1906, and took advantage of channels as little as 1 metre in depth.)

50: I heard that 2010 was the hottest year since records have been kept. The Northwest passage is closed by ice yet it was open in the 1930s. Was 2010 really the hottest year on record? A: *No.*

A revised analysis suggests that 2010 may have been the hottest year on record. A more robust⁴ result is that the hottest years have been 1998, 2005 and 2010.

51: Why has temperature been decreasing since 1998 and yet human emissions of carbon dioxide have been increasing? A: *The Sun dominates the effects of CO₂.*

This question is based on a false premise— temperatures are not decreasing — 2001-2010 is the hottest decade of the instrumental record.

52: What is the mechanism that causes warming trends to reverse? Will that mechanism kick in with human-induced global warming? A: *The Sun. Confused answer to second part invoking orbital changes.*

⁴More robust in the sense of less statistical uncertainty.

Orbital changes affect climate on time scales of many millennia and are irrelevant to the immediate concerns about global warming.

53: The Earth has been warming since the Maunder minimum 330 years ago. Is it surprising that temperature records show a warming over the last 150 years? A: *No.*

Over most most of the last 330 years there has not been sustained warming. The warming is largely confined to the last 150 years (with natural variability⁵ leading to some periods of cooling) and accelerated warming in the later 20th century.

54: How can there be global average temperature? *The ‘answer’ includes “... it really means nothing as it depends on measurement”*

What on earth is that meant to mean?

There are genuine difficulties in defining what the average temperature should mean. This is most commonly addressed by considering temperature ‘anomalies’, i.e. the difference from a fixed reference period. For changes, what this is exploiting is that the ‘rate of change of the average (which is hard to determine directly)’ is equal to ‘the average of the rates of change’.

55: What is the order of accuracy of temperature measurements? A: *The unsupported claim that historical accuracy would be 1.3°C.⁶ and that this means that there has been no detectable temperature rise.*

Averages can be determined more precisely than the individual measurements that contribute to the average.

56: Is it valid to combine inaccurate 19th century temperature records with far more accurate temperature records of the late 20th century? A: *No. But it is done.*

Actually yes, as long as you use the right statistical techniques that take account of the different levels of accuracy. If you use default spreadsheet techniques you will almost certainly underestimate the uncertainty in the results.

57: The number of measuring stations has greatly decreased over the last 20 years with the loss of stations in polar, mountainous, rural and remote areas. Does this create a warming bias to temperature measurements? A: *Yes.*

Actually, fewer data points mean greater uncertainty (other things being equal), but not necessarily a bias.

58: When temperatures are used for models, are the raw temperatures or are corrected temperatures used? A: *No answer given.*

This question is based on a false premise — that the observed temperatures are ‘used’ as inputs to climate models – the primary role of climate models is to compute temperatures and other meteorological quantities as **outputs** of the model.

59: What is the urban heat island effect? A: *Sketchy indirect answer padded out with derogatory comments about teachers.*

⁵Some of the post WW2 cooling may have been human (from increased aerosols) rather than natural.

⁶There is also a silly mistake in the claim that 20.0 ± 0.1 means anything from 19.9 to 21.1.

A relative local warming due to energy use and heat storage in urban areas differing from the surrounding region.

60: Is there a standard method to correct for the urban heat island effect? A: .. *there is an equation by Oke and scientific arguments about whether this equation tells the real story.*

There is no standard method for correcting such data — each site needs to be considered on a case-by-case basis. One ‘standard’ approach in assembling climatological time series is to exclude urban sites.

61: If land temperatures have to be adjusted how do we know that the adjusted temperatures are accurate? A: *No answer given.*

Recent Berkeley Earth Surface Temperature (BEST) project has done an independent cross check of the statistical treatment of the temperature data.

See four papers submitted for peer review posted at: <http://www.berkeleyearth.org/resources.php> along with the data.

62: If “adjusted” temperatures are used for computer projections of future climate, how can we trust these models? A: *No answer given.*

Note from Q58 that the concept of temperature data being ‘used’ in models is misleading.

63: Why have computer models that predicted high altitude warm air at the equator as a result of increased human emissions of carbon dioxide failed? A: *No answer given as to ‘why’.*

The discrepancy has been resolved.

64: Computer models predicted that the sea surface temperature would warm yet measurements show that there is cooling. Why? A: *No answer given as to ‘why’.*

Actually Figure 26 of *How to Get Expelled from School* is a fabrication. There is no reference for the claim that GISS predicted 6 degrees warming from 2003 to 2009. The reference cited for the alleged observed cooling does not appear in the list of references. The claim the computer models are the **only** basis for the idea that human emissions of carbon dioxide drive climate change is false — the association between CO₂ and warming was identified by Arrhenius in 1896.

65: What information is accepted and rejected in models of future climate? A: *No answer is given – just speculation about what a teacher might say.*

The question does not actually make much sense.

66: Computer models predict future climate changes far less than the changes experienced by humans over the last 6000 years. Why should we worry about future climate? A: *No answer given.*

This question is based on a false premise — the predicted changes (in the event of continued growth in CO₂ emissions) are much greater than changes over the last 6000 years.

67: The models, code and data used by the IPCC for their climate predictions are not available yet computer climate predictions are the basis for suggestions of human-induced global warming. How can their predictions be independently checked? A: *No answer given.*

The most important check is to consider how well such models have performed in the past (see Q68). It can be also useful to consider how well the models represent the current climate state.

For various models:

the ‘model’ (i.e. the defining equations) is usually available in the scientific literature; in a few cases, the ‘code’ (i.e. the computer implementation of the equations) is available; for many model runs, especially those reported by the IPCC, the ‘data’ (primarily model outputs) are available.

Thus Plimer’s characterisation of the situation is not really correct. The primary form of ‘independent checking’ by experts is independent model development. Others (for whom independent model development is not an option), the criteria given in the first paragraph remain possible.

68: How can I have confidence in the predictions of a climate model if I don’t know how it works and it has been shown to be wrong? A: *No answer given.*

The successes of long-term prediction from climate models is noted in my book *Twisted: the distorted mathematics of greenhouse denial*. The most important long-term prediction is of 0.3°C per decade (range 0.2 to 0.5°C per decade) in the 1990 IPCC report. The actual changes over the subsequent two decades are within that range and only a little below the central estimate. For more detail see figure TS.26 of the 2007 IPCC report.

69: Would you expect a warm climate after the Little Ice Age? A: Yes.

Actually not necessarily. A name like ‘Little Ice Age’ is usually applied to a period that is distinct from what came before and after it. If the climate had evolved differently (e.g. absence of human influence, further weakening of the Sun, cosmic dust clouds, greatly increased volcanic activity etc) we might have been seeing the ‘Little Ice Age’ as a relatively mild cooling preceding a “Not-So-Little Ice Age”.

70: Since the depth of the Little Ice Age 300 years ago, the Earth has been warming. Which part of this warming has been natural? A: *All natural except (possibly) the warming from 1977 to 1998.*

Most of the warming has been in the last 150 years, accelerating over the last decades of the 20th century. Most of this latter part is due to human influence. See analysis by Stott et al. [2001], c.f. Q10.

71: If most of the last 330 years of warming is natural, why isn’t all the latest warming natural? A: *It probably is, but really don’t know.*

For the literal question: ‘why isn’t all the latest warming natural?’ the answer is: because humans have been perturbing the earth’s radiative balance.

For the implicit question: ‘how do we know the latest warming isn’t natural?’, see Q46.

72: Why are there 60-year cycles of warming and cooling over the last 2000 years? A: *No answer given.*

More importantly *How to Get Expelled from School* does not provide any evidence of such 60-year cycles. For comparison, fig 22 of *Heaven + Earth* is a table of ‘known cycles’ that does not include a 60-year cycle. Yet another example of a question based on a false premise.

73: During ice ages do we get cycles of warm interglacials and cold glaciations. A: *Yes.*

Plimer’s answer agrees with mainstream science.

74: Why do we get cycles of glaciation and interglacials? A: *A confused response (with yet more vilification of hypothetical teachers).*

The core point that the cycles are driven by orbital changes agrees with mainstream science.

75: Would you expect a warm climate in an interglacial? A: *Yes.*

Plimer’s answer agrees with mainstream science.

76: Ice cores show a saw-tooth interglacial-glacial pattern with huge temperature variations in cold times. Why does temperature reach a maximum and then fall and why were all past temperature maxima about the same? A: *The saw-tooth shape derives from the orbital cycles. The temperature limits are set by buffering effects of the water cycle..*

The changes on the orbital effects do not have a saw-tooth shape. The saw-tooth shape is rather a consequence of ice-sheets being slow to build up but faster to break up. Since the glacial-interglacial temperature cycle is closely coupled to the carbon cycle (see Q77) one contribution to limiting temperatures may be a limit to the amount of carbon that can be transferred (between atmosphere and ocean) by the temperature feedback process. However, there is still much to learn about the glacial-interglacial cycles.

77: Ice core records show that carbon dioxide in the air increases 800 to 2000 years after a natural event of global warming. Does temperature drive an increase in carbon dioxide or do ice cores show that an increase in carbon dioxide drives temperature? A: *An increase in temperature leads to an increase in carbon dioxide.*

Increased temperatures can drive an increase in carbon dioxide AND an increase in carbon dioxide drive an increase in temperature (c.f. Q35). The glacial-interglacial changes are initiated by changes in the Earth’s orbit. The amplifying effect from subsequent changes in CO₂ means that the climate changes are larger than would be expected from the orbital changes alone.

78: Does sea level rise and fall? A: *Yes.*

Plimer’s answer agrees with mainstream science.

79: Does the land level rise and fall? A: *Yes.*

Plimer’s answer agrees with mainstream science

80: If sea level goes up and down and land level goes up and down, how is global sea level measured? A: *With difficulty.*

Interpreting tide gauge data is indeed difficult. Since 1993 satellite measurements have greatly improved the precision of estimates of sea level.

81: Why did the rate of sea level rise double as soon as satellites started to measure sea-level?

A: One little adjustment to the computer and you can get whatever number you want.

Actually rate of sea level rise didn't double. Fig 30 of *How to Get Expelled from School* distorts the data. The 1.6 mm/year from tide gauges is an average over the whole of the 20th century; the average for the decades immediately before 1993 (when satellite data began) is higher. See the last plot in:

http://www.cmar.csiro.au/sealevel/sl_hist_few_hundred.html

82 Did sea level rise in the 400-year long Medieval Warm Period and the 600-year Roman warming? A: Probably no.

Since Plimer's evidence for higher temperatures in Roman and MWP turns out to be fabricated (in [1], I show in particular than NONE of the scientific papers cited by Plimer in connection with the Roman warming give any support for his claim of 2 to 6 degrees warmer) — without documented warming, it is not surprising if associated sea-level rise was also non-existent.

83: Is sea level rising now? A: Yes, by an unknown amount.

The decadal scale trend is 3.4 ± 0.4 mm/year — see

http://www.cmar.csiro.au/sealevel/sl_hist_last_15.html

with a drop during the recent la Niña period.

84: Would we expect sea level to rise in an interglacial? A: Yes.

Plimer's answer agrees with mainstream science.

85: How much has sea level risen in the current interglacial and how long did this take? A:

About 130 metres mostly over the period 12000 years ago to 6000 years ago.

Plimer's answer agrees with mainstream science.

86: Why does sea level rise? A: A rather confused answer.

The reasons for global sea-level rise include: thermal expansion of ocean water; melting of land-based ice; less water on land during El Niño episodes; changes in the areas and depths of ocean basins.

Regional changes in sea-level can arise from changes in ocean currents and apparent changes can arise from changes in the level of land (see Q87).

87: Is the land sinking at Venice or is Venice being flooded because of sea level rise? A: Venice is sinking.

Land can sink due to extraction of groundwater (e.g. Venice and New Orleans) and, as a result of adjustment to the loss of ice-caps can either rise or sink (as in the case of London).

88: Is the land rising in Eastern Australia? A: Yes.

Yes, but only slowly and only in the south.⁷

89 Why are there old beaches in the Murray Darling basin hundreds of kilometres from the modern shoreline and over 100 metres above sea level? A: *Large changes in level of both sea and land.*

Plimer's answer agrees with mainstream science.

90: If sea level has risen to separate Tasmania from Victoria, is the same process still in operation? A: Yes.

Plimer's answer agrees with mainstream science. However since the relevant 'on-going process' is the cyclic orbital changes associated with glacial-interglacial cycles, this does not mean that this will cause further sea-level rise.

91: How did aboriginal people get to Australia before boats were invented? A: *They walked from Irian Jaya during the last deglaciation.*

This begs the question of how they got to Irian Jaya, since the lower sea levels still left several large sections of ocean between Australia and the Asian mainland. These were presumably crossed using primitive water craft. Plimer's 'before boats were invented' is implausible at best.

92: Which part of present sea level rise is due to post-glacial sea level rise and which part is due to human activity? A: *Don't know, but human contribution is small.*

Post-glacial sea-level rise is largely finished (see Plimer's own answer to Q85).

93: Why do Al Gore and Tim Flannery tell us that sea level will rise more than 8 metres and yet they have expensive waterside properties? A: *No answer given.*

Because 8 metres of sea level rise is a long way into the future. Al Gore's movie was rightly criticised in the UK court case for failing to point this out.

94: What is pH? A: *The negative log of the hydrogen ion activity in a solution.*

Plimer's answer agrees with mainstream science.

95: What is the pH of the oceans? A: *Oceans are alkaline — pH from 7.5 to 8.4.*

Plimer's answer agrees with mainstream science.

96: What is a buffer? A: *A buffer adjusts the pH of a solution.*

A better answer is that a buffer reduces the amount that the pH of a solution changes in response to adding acids or alkalis.

97: Why haven't the oceans become acid in past times when atmospheric carbon dioxide was high? A: *Sea water and sediments act as buffers.*

Plimer's answer agrees with mainstream science.

⁷See "The tilting continent: A new constraint on the dynamic topographic field from Australia", Mike Sandiford, School of Earth Sciences University of Melbourne. *Earth and Planetary Science Letters* Volume 261, Pages 152–163.

98: Is there any activity in my life that does not involve the emission of carbon dioxide? A:
No.

Plimer's answer agrees with mainstream science. Except that Plimer's final 'drop dead' suggestion would (or will, since death (like taxes) is inevitable) release more CO₂.

99: Why do those advocating human induced global warming vilify those who disagree ...?

A: *To avoid answering questions.*

Mostly scientists don't engage in public name-calling. (If you want to see the sort of thing they say in private, see the stolen UEA e-mails.) In contrast, Plimer, repeatedly calls Michael Mann fraudulent, in spite of many inquiries clearing him.

Note also Fred Seitz's denigration of Ben Santer and Garth Paltridge's op-ed on scientists being 'bought'.

For video of activist climate denialists threatening climate scientist H. J. Schellnhuber with a hangman's noose at a public lecture on climate, see:

http://scienceblogs.com/deltoid/2011/07/another_day_another_death_thre_1.php

Of course, much of the '101 questions' consists of Plimer's vilification of teachers.

100, 101: 100: What funds does the Australian government give for grants annually to show the existence of human induced global warming? and 101: What funds does the government grant to consider the possibility that there might not be human-induced global warming? A: 100: \$142 millions. A: 101: Zero.

These questions are based on the false premise — that funding is for a pre-determined outcome.

More on the book

This document concentrates on the 101 questions and not on the book as a whole. Further information about the book, its predecessor, and publicity about them can be found at:

- My own analysis of errors in *Heaven + Earth* [1].
- Mike Sandiford's op-ed in the Australian: 31/12/2011.
- The Deltoid blog noting plagiarism [4].

References

P. A. Stott, S. F. B. Tett, G. S. Jones, W. J. Ingram, and J. F. B. Mitchell. Attribution of twentieth century temperature change to natural and anthropogenic causes. *Climate Dynamics*, 17:1–21, 2001.

Additional information on-line

1. Ian Enting's analysis of *Heaven + Earth* is at:
http://www.complex.org.au/tiki-download_file.php?fileId=91
2. <http://adsabs.harvard.edu/abs/2007AGUFM.P31D..05R>
for analysis⁸ of evidence showing that Mars has not had a long-term warming trend.
3. <http://www.readfearn.com/2011/12/climate-science-denier-ian-plimer-telling-porkies-on-primetime-telly/>
4. http://scienceblogs.com/deltoid/2011/12/the_australians_war_on_science_78.php
Describes how a section of *How to Get Expelled from School* is actually plagiarised from a press release (after modifying a few words so as to reverse some of the conclusions.)
5. The 'Plimer vs Plimer' analysis is on the 'Skeptical Science' website.

Glossary

climate sensitivity The amount of warming caused by doubling CO₂.

Eemian Most recent interglacial time. Peaked 131 to 114 thousand years ago.

ice age The has two common meanings: (a) long period with large amounts of ice; (b) the colder (glacial) periods with in such an ice age, which alternate with warmer (interglacial) periods. Thus we are currently in an interglacial within an ice age that has lasted tens of millions of years.

natural “existing in or formed by nature; not artificial”. This is meaning (1) for ‘natural’ in the *Macquarie Dictionary* (revised edition, 1985). Similarly, ‘artificial’ has meaning (1): “made by human skill or labour (opposed to natural)”. By disputing the distinction between ‘human’ and ‘natural’ (in Q29), Plimer puts himself at odds with other users of English.

About the author

Ian Enting trained in mathematical physics. From 1980 to 2004 he worked for CSIRO modelling the carbon cycle. He is currently a professorial fellow in the ARC Centre of Excellence for Mathematics and Statistics of Complex Systems. His book *Twisted: The Distorted Mathematics of Greenhouse Denial* (2007) provides a deconstruction of arguments used to deny the reality of a human influence on climate.

Enquiries about buying the *Twisted* should be sent to twisted.ige@gmail.com

⁸Thanks to Skeptical Science website for link

Acknowledgements

As with my analysis of *Heaven + Earth* [1], this summary has benefitted from feedback from a number of colleagues and correspondents. Nevertheless, all errors are my responsibility.

Disclosure of interest

Ian Enting's mother was a school teacher. Both his sisters have been school teachers. His brother has taught in secondary and TAFE systems.

Version history

This is version 1.0.

The intent is that the link:

`http://www.complex.org.au/tiki-download_file.php?fileId=134`

will always address the most recent version of this document.

- Test version 0.9 on MASCOS website, 23/3/2012.
- Confidential versions of this document were circulated for comment in February and March 2012.

Typeset March 27, 2012