

Oliphant Science Awards

Science Inquiry Logbook
1/2/20

Australia has had massive bushfires during this summer. Many people lost their lives during this time, it's catastrophic.

But why is this ~~not~~ happening?

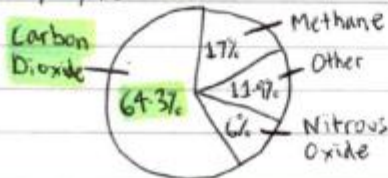


3/2/20 ✓

HUMANS cause global warming from producing green house gases.

The temperature has been rising rapidly from the 1960's.

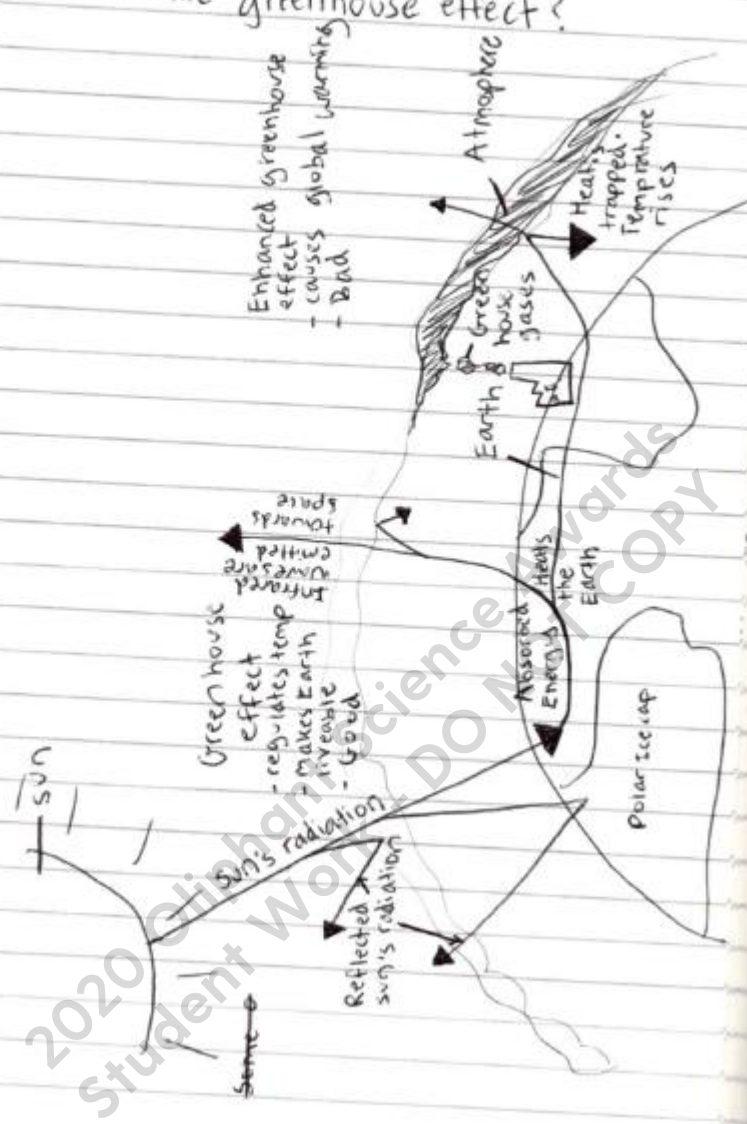
4/2/20 What are greenhouse gases?



Carbon Dioxide is the major greenhouse gas produced by humans.

7/2/20

What is the greenhouse effect?



Enhanced greenhouse effect - causes global warming - Bad

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8/2/20

I want to see if this is true by doing an ~~an~~ experiment

Research Question: Does Carbon Dioxide affect the temperature of the atmosphere?

- Vague, doesn't show the relationship between increases of CO_2 and increases in temperature

Improved question: Does increasing the concentration of carbon dioxide in the atmosphere cause ~~the atmosphere~~ ^{it} to warm?

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8/2/20 experiment

Doing the experiment:

What needs to be done	How to do it
<ul style="list-style-type: none">• Measure temperature• Purchasing CO_2	Liquid thermometers (cheap) Using ENO (includes Sodium Bicarbonate and Acid which produces salts, water and CO_2 when mixed with water)

9/2/20

Containing CO_2 (gaseous)	Bottles with caps (air tight)
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Using different concentrations of ENO	Weighing scale to measure mass of ENO. Measuring
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Cylinders to measure volume of water.

Heating the bottles (represents the sun)	Heat lamp (equal distance from bottles - arrange in a semi circle)
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10/2/20

What is a fair test? ^{what we change.} ^{what we measure}
where there is 1 independent variable, 1 dependent variable and everything else being controlled.
Mass of ENO Temperature

Test #1 10/2/20

Question - ~~Does Carbon Dioxide affect the temperature of the atmosphere?~~
Does the ^{increase of} concentration of Carbon Dioxide result in increases of atmospheric temperatures?

Experiment Outline -

4 thermometers will be placed in to holes the caps of 4 plastic bottles. ~~200ml~~ 500ml of water will be poured into each bottle. A different amount of ENO powder (0g, 2g, 5g, 10g) will be put inside the bottles. The lids will be screwed on and observations of the temperatures will be made over 60 minutes.

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Test #1 -

10/2/20

produces
(Carbon Dioxide)

Hypothesis - The more ENO[↑] put in the bottles the higher the ending temperatures will be.

Variables:

Independent: The ~~amount (g)~~^{mass (g)} of ENO put inside the bottles

Dependent: The temperature (ending) of the air in the bottle

Control/constant: - Type, size, brand of bottles

- Type of thermometers
- Temperature of the room
- Amount and temperature of water
- Type of weighing scale
- Heat lamp temperature
- Amount of air in bottle

Equipment - 4 plastic bottles - weighing scale

- Labels + Markers - Measuring cylinder
- Water (2L)
- ENO (17g) - Funnel
- 4 thermometers - Screwdriver
- Blu-tack (to poke holes in the lids)
- Heat lamp
- Stop watch
- Log book + pen

Test #1 - Results

(minutes)	(Degrees celcius)			
Time	0g	2g	5g	10g
0	22	22	23	22
5	26	26	28	29
10	28	28.5	31 ^v	33
15	29	30	32.5	36
20	29.5	31	33	37
25	29.5	31	33.5	38
30	30	31	34	38.5
35	30	31.5	34	39
40	30	31.5	34.5	39
45	30.5	31.5	35	39.5
50	30.5	32	35	40.5
55	30.5	32	35	40.5
60	30.5	32	35.5	41

Improvements:

- There is not much variation within this results using more ENO such as 20g will provide more variation.
- To see if the ENO itself is not producing heat from chemical reactions as a separate bottle with 20g ENO, 500ml water should be placed away from the heat and also observed every 5 minutes for 60 minutes.

Test #2 - Improved test

15/2/20

Question - Does increases in concentration of carbon Dioxide (ENO) ~~can~~ lead to rises in atmospheric temperature?

Experiment - 1. Holes ~~will be~~ are ~~apertures~~ punctured with a screw driver into 5 plastic bottle lids. 5 thermometers are

then pushed into these holes so that 0°C ~~is~~ can just be seen

2. Blu tack is ~~is~~ then wrapped around the lid to stop any CO_2 from escaping

3. 500ml of water is ~~x~~ poured into each (5) bottles.

4. ENO is ~~be~~ measured on the weighing scale (10g, 5g, 10, 20g, 20g) then poured into each bottle.

5. The caps of these bottles (with the thermometers in it) ~~is~~ will be immediately screwed on, to let NO carbon dioxide escape.

6. One of the 20g ENO bottles ~~will be~~ is placed away from the heat lamp while the others ~~will be~~ are placed in a semi circle around it.

7. The heat lamp is turned on. Every 5 min the temperatures of each bottle is recorded.

Test #2

Hypothesis - The higher concentration of ENO, the higher the temperature will rise.

Equipment -

- 5 plastic bottles with lids
- Label & Marker
- 2.5L of water
- 55g of ENO
- 5 Thermometers
- Blu tack
- Heat lamp
- Stop watch
- Log book and pen/pencil
- Weighing scale
- Measuring cylinder
- Funnel
- Screwdriver

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Test #2 - Results

(No Heat)

Time	0g	5g	10g	20g	20g
0	23	22	22	23	23
5	28	26	32	32.5	23
10	29	29.5	34.5	35	23.5
15	30	31	36	37	23.5
20	30.5	32	37	39	23.5
25	30.5	33	38	40	23.5
30	31	33.5	38.8	40.5	23.5
35	31	34	39.5	41	23.5
40	31	34	40	41.4	23.5
45	31.5	34.5	41	42	23.5
50	32	35	41	43	24
55	32	35.5	41	43	24
60	32	35.5	41.4	43.5	24
(mins)	(°C)	(°C)	(°C)	(°C)	(°C)

Notes for discussion & evaluation:

Potential issues: Random, systematic, parallax, (errors) Zeroing.

Discussion

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Discussion Notes:

• What is the green house effect?

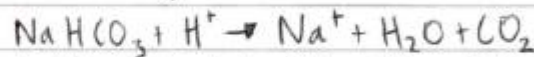
- Enhanced greenhouse effect

see notes from 7/2/20

• Chemistry of ENO - how it makes CO_2

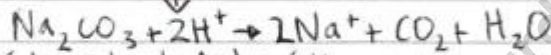
8/2/20 ENO is an antacid - contains sodium Bicarbonate, Sodium carbonate and Citric Acid Anhydrous (dry). when water is added.

↓



Sodium Bicarbonate + Acid \rightarrow Salt + Water + Carbon Dioxide

↓



Sodium carbonate + Acid \rightarrow Salts + Carbon Dioxide + Water

• The graph structure of the results (20/2/20)

Each concentration of ENO rises rapidly then plateaus out. Why?

As the molecules in the bottles receive energy from the heat lamp they radiate some back out. When the bottle is colder than the less is radiated out. But as it gets hotter more ~~an~~^{air in the} is radiated until eventually the energy in and out is equal and so the temperature stops rising (plateau)

Discussion Notes Continued:

20/2/20

- Ending temperatures

The ~~no~~ higher concentration of ENO the higher the ending temperature was.

0g ENO	5g ENO	10g ENO	20g ENO
32°C	35.5°C	41.4°C	43.5°C

- This confirms hypothesis - ~~Carbon dioxide~~
The greater concentration of CO₂ in the air, the greater ^{the temperature} will rise.

20/2/20

- The temperature of the bottle with no heat ~~was~~ only rose by 1°C, to 24°C - probably due to ~~equib~~ equilibration with the room temperature. This proves that the heat rise was not due to the ENO itself under going a ^{temperature} chemical reaction and producing heat.

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Evaluation of Inquiry

Potential errors - Systematic
23/2/20

parallax zeroing

random

rounding

- poor accuracy
- definite causes
- reproducible

- poor precision
- non specific causes
- not reproducible

can be solved by removing the error cause

can be solved by repeating the experiment and averaging

24/2/20

Further Investigation and improvements

- Using even larger amounts of ENO to see if over rising amounts of CO_2 cause ever rising temperatures or if it plateaus out or starts to drop at some point

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Bibliography

web pages or
word document

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- 3/2/20 Scientific consensus: Earth's climate is warming. NASA.
- 4/2/20 A student's guide to global climate change - Greenhouse gases.
- 7/2/20 Greenhouse Effect - Department of Agriculture, Water and the Environment.
- 8/2/20 ENO ingredients - Enotes.
- 10/2/20 Fair test - A do-it-yourself guide - Understanding science.
Fair test - School curriculum and standards Authority Government of Western Australia.
- 11/2/20 Experiments - S-cool the revision website.

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