



# **Nurturing Gifted Thinkers: Philosophical Inquiry as Catalysts for Climate Change Awareness**

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# School Context - HKUGA College

- DSS Co-ed EMI School
- Lesson tryout in S2 Science

# Conventional approach of teaching global warming in S1-3

## Facts-based approach

- What is global warming?
- What causes global warming?

# Problems associated with the usual practice

- Address **limited awareness** among students
- NOT confront to **common misconceptions/ myths** surrounding global warming
- **Assume** students will take action if they have know all the facts
- **Limited cognitive engagement** with **gifted students**

# Philosophical Inquiry (PI)

- Also known as P4C (Philosophy for Children)
- Teacher as facilitator
- Thinking tools for students
- Community of Inquiry (COI)
- Implemented across subjects in S1-2

HKUGA College – PI/ Science: Lesson Plan							
Title: Air and Living Things							
Level:	S2	Module:	4a	Lesson:	1	Time:	45 mins
<b>Central Inquiry Question: What caused global warming?</b>							
<b>Inquiry Skills:</b>		- Forming and categorizing questions - Giving reasons - Weighting/ evaluating the quality of evidence and reasons		<b>Community skills:</b>		- Listening attentively - Engaging in dialogue - Showing respect for others' viewpoints	
<b>Content objectives:</b>		- To learn to ask questions to determine whether humans or natural factors are the main cause of increases in global temperatures over the past century - To identify whether the evidence supports claims about the causes of increases in global temperatures - To construct an argument for whether humans or natural factors are the main cause of increases in global temperatures over the past century					

# Philosophical Inquiry (PI) in Science

- Focus on reasoning skills
- Could be an effective pedagogy for Nature of Science (NOS) and Socioscientific issues (SSI)
- Examples of topics:

<b>Topic</b>	<b>Unit</b>	<b>Inquiry skills</b>
What makes something living?	Unit 3 Studying living things	Eliciting criteria
Which is natural?	Unit 5 Energy	Examples and counterexamples
What caused global warming?	Unit 7 Living things and air	Forming questions, Weighting/ evaluating the quality of evidence and reasons

# Learning Objectives: What caused Global Warming?

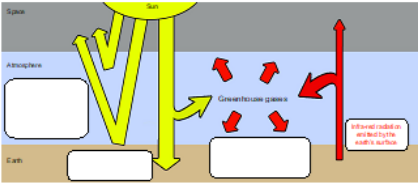

## *Content objectives:*

- To learn to **ask questions** to **determine whether humans or natural factors are the main cause** of increases in global temperatures over the past century
- To **identify whether the evidence supports claims** about the **causes of increases in global temperatures**
- To **construct an argument** for whether **humans or natural factors** are the main cause of increases in global temperatures over the past century

## *Inquiry skills:*

- Forming and categorizing questions
- Giving reasons
- Weighting/ evaluating the quality of evidence and reasons

# Overview of the tasks

Task	Process	Activities	Materials						
Task 1 Setting the stimulus	<b>Reading to learn</b> about the context of greenhouse effect	Students <b>read an article</b> about the greenhouse effect followed by a labelling and interpreting a diagram of greenhouse effect.							
Task 2 Competing claims	<b>Questioning</b> about the evidence required	Students <b>ask scientific questions</b> to clarify two <b>opposite claims</b> about the main cause of global warming (i.e. human factors vs. natural factors).							
Task 3 Discussing evidence	Discussion about the <b>evidence</b>	Students <b>examine</b> eight pieces of <b>evidence</b> and <b>identify which claims is supported</b> .							
Task 4 Constructing an argument	<b>Evaluating</b> claims with evidence and <b>reasoning</b>	Students <b>construct an argument</b> for one of the claims and <b>critique</b> the alternative claim.	<p>Your task: Construct an argument for Mary or Peter by selecting the claim and completing the parts for evidence and reasoning.</p> <table border="1"> <thead> <tr> <th>Claim</th> <th>Evidence Select 1-3 from the evidence cards (can be more than one)</th> <th>Reasoning Explain how the evidence supports the claim</th> </tr> </thead> <tbody> <tr> <td>Greenhouse gas emissions from human activities are / nature is* the main cause of the increase in temperature in the past century. * delete one</td> <td></td> <td></td> </tr> </tbody> </table>	Claim	Evidence Select 1-3 from the evidence cards (can be more than one)	Reasoning Explain how the evidence supports the claim	Greenhouse gas emissions from human activities are / nature is* the main cause of the increase in temperature in the past century. * delete one		
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## Ground rules

### Philosophical Inquiry Norms

There may not always be a single  
correct answer

We listen to one another to understand

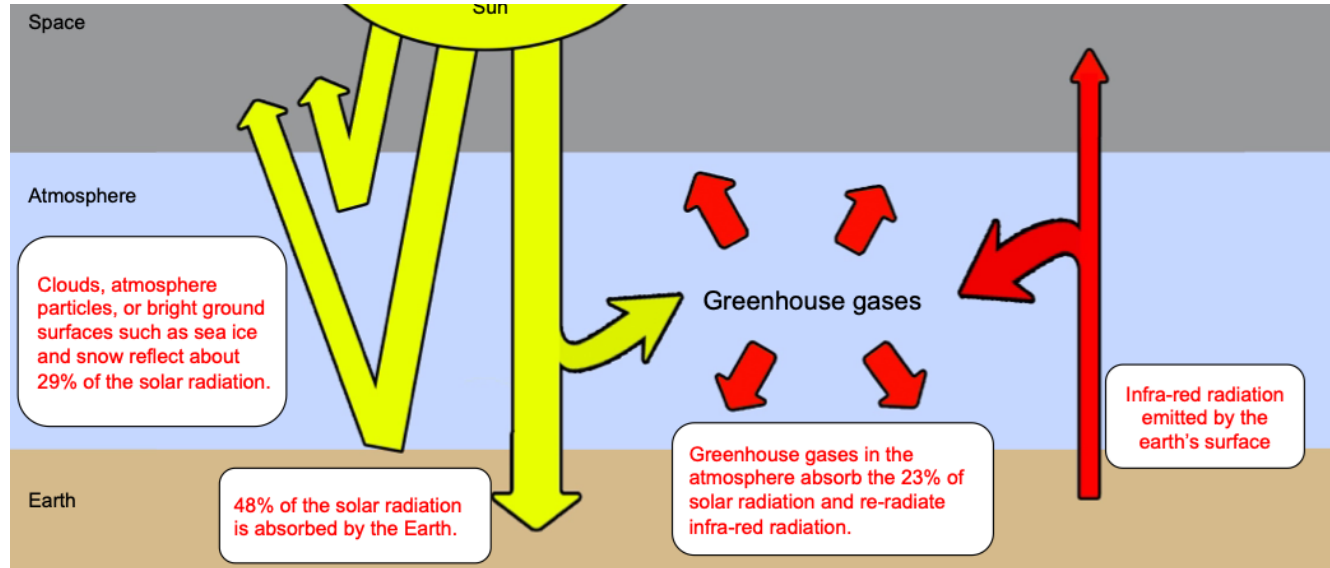
We build on other's ideas

We respect ourselves, others and our  
learning environment

# Task 1: Setting the stimulus

## How can greenhouse gases cause the temperature of the Earth to rise?

To understand how greenhouse gases have caused the temperature of the Earth to increase, consider all solar radiation that arrives at the Earth's atmosphere. Clouds, atmosphere particles, or bright ground surfaces such as sea ice and snow reflect about 29% of solar radiation. The Earth absorbs about 48% of the solar radiation, the molecules vibrate faster and transfer energy to other molecules through collisions, thereby increasing temperature. Greenhouse gases in the atmosphere absorb the remaining 23% of solar radiation and re-radiate infrared radiation that cannot pass through the atmosphere to space without being reabsorbed. Without the natural greenhouse effect, the average temperature at Earth's surface should be below the freezing point of water. Thus, Earth's natural greenhouse effect makes life as we know it possible. However, human activities, primarily the burning of fossil fuels and clearing of forests, have greatly intensified the natural greenhouse effect, causing global warming.

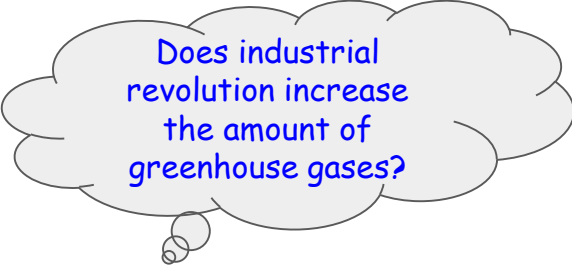


# Task 2: Competing claims

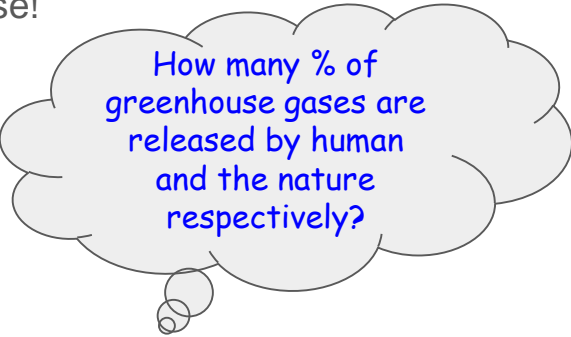
The Earth has warmed about 1.09 oC over the past century (100 years). Two students are discussing whether human activities or the nature is the main cause.

**Mary:** *Human* activities are the main causes!


**Peter:** *Nature* is the main cause!




Does industrial revolution increase the amount of greenhouse gases?



How many % of greenhouse gases are released by human and the nature respectively?



How much greenhouse gases do the air-conditioners release every year?



How much greenhouse gases is released by the farting of cow?

- **Why do you ask this question? How does it help you determine the main cause?**
- **What information would you like to collect by asking this question?**
- **Does this question support the claim of human activities or nature as the main cause?**
- **Anyone would like to comment on this question?**

# Task 3: Discussing evidence

**Mary:** *Human* activities are the main causes!

**Peter:** *Nature* is the main cause!

Referring the given evidence, put an X in the box that you think the evidence support the claims below.

Evidence	Whom does the evidence support?		
	Mary	Peter	Neither
Humans emit over 10 times the amount of greenhouse gases than they did a century ago.	X		
Earth's hottest periods occurred before humans existed.		X	
The temperature of the Earth in the past century has increased more than any other time in the past 10,000 years.	X		
Volcanos release greenhouse gases.		X	
In 2010, humans released over 100 times the amount of greenhouse gases than all the volcanoes in the world.	X		
Ninety-seven percent of papers in scientific journals support the idea that changes in the climate are caused by humans.	X		
Methane and nitrous oxide are stronger greenhouse gases than carbon dioxide.			X
In the United States, from 1990 to 2020, there has been a 62% increase in the emissions of methane and nitrous oxide from the livestock.	X		

Who's claim is better?

Use evidence and reasoning to support your claims.

# Task 3: Discussing evidence

**Mary:** *Human* activities are the main causes!

**Peter:** *Nature* is the main cause!

Who's claim is better? Use evidence and reasoning to support your claims.

**Mary's idea is better than Peter's** because the **evidence better supports her idea.**

First, "humans emit over 10 times the amount of greenhouse gases than they did a century ago" and greenhouse gases absorbed infra-red radiation, which causes temperature to increase.

Second, Volcanoes release greenhouse gases, but it is a small amount compared to the amount of greenhouse gases emitted by humans.

Third, "the temperature of the earth in the past century has increased more than any other time in the past 10,000 years", which suggest that the current temperature cannot be explained by the natural causes.

Finally, the evidence that "97% of papers in scientific journals support the idea that changes in the climate are caused by humans" supports the claim that human are the primary cause of the increase in global temperature since temperature over time is an example of climate.

Claim

Evidence

Reasoning

# Task 3: Discussing evidence

**Mary:** *Human* activities are the main causes!

**Peter:** *Nature* is the main cause!

Who's claim is better? Use evidence and reasoning to support your claims.



- Which evidence are you using to support your claim?
- How does this evidence support your claim?
- Why is this evidence stronger than the other evidence(s)?
- Do you agree/disagree or have any comments on his/her claim? Why?
- Does this piece of evidence really support the claim of human activities / nature?

# Task 4

## Your task:

Construct an argument for Mary or Peter by selecting the claim and completing the parts for evidence and reasoning.

<b>Claim</b>	<b>Evidence</b> Select 1-8 from the evidence cards (can be more than one)	<b>Reasoning</b> Explain how the evidence supports the claim
Greenhouse gas emissions from <b>human activities are</b> / <b>nature is*</b> the main cause of the increase in temperature in the past century.  <i>* delete one</i>		

# Summary

- **Philosophical Inquiry (PI)** as a pedagogy to **promote thinking**
- Teacher as **facilitators**, students as **questioners** and **thinkers** (NO judging)
- **Facilitation moves** (questioning) to elicit students thinking
- **Claim-Evidence-Reasoning** framework for **scientific argumentation**
- Further discussion about **socioscientific issues**:  
political, economic, and social issues that arise, in addition to science



# Thank you!

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