

## Chp 2 Gateway 2 – What is happening to the earth's climate?

Subject content:

Learning Outcomes	Content	Main Terms
<b>Key Question 2: What is happening to the Earth's climate?</b>		
<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>Describe and explain climate change since 1880</li> <li>Explain the greenhouse effect</li> <li>Discuss the natural causes of recent climate change</li> <li>Explain how human activities lead to enhanced greenhouse effect</li> </ul>	<p><b>A) Knowledge</b></p> <ul style="list-style-type: none"> <li>Changes in climate               <ul style="list-style-type: none"> <li>Global records since 1880 show a significant, but irregular upward trend in temperature with fluctuations of 0.3°C to 0.6°C</li> <li>Global warming over the last century: world is warming on average by 0.74°C, with most of the increase since the 1970s</li> <li>Global temperatures in the last decade reached the highest levels on record</li> </ul> </li> <li>Greenhouse effect is a natural process by which greenhouse gases trap heat in the atmosphere</li> <li>Human activities have contributed substantially to climate change by adding greenhouse gases to the atmosphere, hence enhancing the greenhouse effect</li> <li>Natural causes of recent climatic change               <ul style="list-style-type: none"> <li>Variations in solar output</li> <li>Volcanic eruptions – cooling influence</li> </ul> </li> <li>Anthropogenic factors leading to enhanced greenhouse effect               <ul style="list-style-type: none"> <li>Deforestation and associated increase in atmospheric carbon dioxide</li> <li>Changing land use and associated increase in greenhouse gases                   <ul style="list-style-type: none"> <li>Agriculture (e.g. burning of fossil fuels to provide energy to operate machines in rice farming, methane produced by cattle farming)</li> <li>Industry (e.g. burning of fossil fuels to provide energy for manufacturing, greenhouse gases as by-products of manufacturing)</li> <li>Urbanisation (e.g. burning of fossil fuels to provide energy for household activities and transport)</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Global climate change</li> <li>Global warming</li> <li>Greenhouse gases</li> <li>Greenhouse effect</li> <li>Enhanced greenhouse effect</li> <li>Anthropogenic factors</li> <li>Deforestation</li> <li>Agriculture</li> <li>Industry</li> <li>Urbanisation</li> </ul>

Learning Outcomes	Content	Main Terms
<ul style="list-style-type: none"> <li>• Discuss the impact of climate change</li> <li>• Describe the responses to climate change</li> </ul>	<ul style="list-style-type: none"> <li>• Impacts of climate change               <ul style="list-style-type: none"> <li>– Sea level rise                   <ul style="list-style-type: none"> <li>○ Threatens low lying areas and islands</li> </ul> </li> <li>– More frequent extreme weather events                   <ul style="list-style-type: none"> <li>○ Heat waves</li> </ul> </li> <li>– Spread of some infectious insect-borne diseases                   <ul style="list-style-type: none"> <li>○ Dengue fever</li> <li>○ Malaria</li> </ul> </li> <li>– Lengthen the growing season in certain regions                   <ul style="list-style-type: none"> <li>○ Fruit production (e.g. in Eastern Canada)</li> <li>○ Vineyards (e.g. Italy in Europe)</li> </ul> </li> </ul> </li> <li>• Responses and challenges to climate change               <ul style="list-style-type: none"> <li>– International agreements                   <ul style="list-style-type: none"> <li>○ Kyoto Protocol                       <ul style="list-style-type: none"> <li>➢ Clear targets for each country to reduce greenhouse gas emissions</li> <li>➢ Countries accountable for meeting their targets</li> </ul> </li> </ul> </li> <li>– National responses                   <ul style="list-style-type: none"> <li>○ Singapore                       <ul style="list-style-type: none"> <li>➢ Strategies to reduce greenhouse gas emissions focusing on energy efficiency and energy conservation, new building requirements and technologies</li> </ul> </li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Sea level rise</li> <li>• Insect-borne diseases</li> <li>• International agreement</li> <li>• Energy efficiency</li> <li>• Energy conservation</li> </ul>
	<p>B) <u>Skills</u></p> <ul style="list-style-type: none"> <li>• Extract information, describe trends and draw conclusions from graphs on temperature and greenhouse gases</li> </ul>	



**Global climate change:** variation in global climate / climatic patterns in long term

→ major changes in temperature, precipitation, wind patterns (occurred over decades or longer)

**Global warming:** increase in global temperatures over long period of time

## Natural causes of climate change

Natural causes:

Cause	Explanation	Examples
<b>1. Variations in solar output</b> (temporal) 	<ul style="list-style-type: none"> <li>Periods of intense solar magnetic activity → higher sunspot activity               <ul style="list-style-type: none"> <li>Number of sunspots increase</li> <li>Higher solar radiation (areas surrounding cooler sunspots radiate more energy, compensate for lower temperature of sunspots) → hotter solar flares</li> </ul> </li> <li>More sunspots → higher temperature</li> <li>Temporal: solar activity cycle lasts for 11 years</li> </ul>	<ul style="list-style-type: none"> <li>2000: no. of sunspots max → higher solar activity → global temp increase</li> <li>2009 ~ 2010: no. of sunspots min → global temp lower than past 20 years</li> </ul>
<b>2. Volcanic eruptions</b> (long-lasting) 	<ul style="list-style-type: none"> <li>Volcano eruption → release large volumes of substances into atm               <ol style="list-style-type: none"> <li>sulfur dioxide</li> <li>carbon dioxide</li> <li>water vapour</li> <li>dust</li> <li>ash</li> </ol> </li> <li>Sulfur dioxide + water → sulphur-based particles               <ul style="list-style-type: none"> <li>Particles reflect solar energy back into space → lower temperature (cooling)</li> </ul> </li> </ul>	<b>Mount Pinatubo</b> , Philippines (1991) <ul style="list-style-type: none"> <li>release 17 mil. tonnes of SO<sub>2</sub> into atm</li> <li>temp in northern hemisphere ↓ 0.6°C</li> <li>temporary lowering of global temp for 2 years</li> </ul>

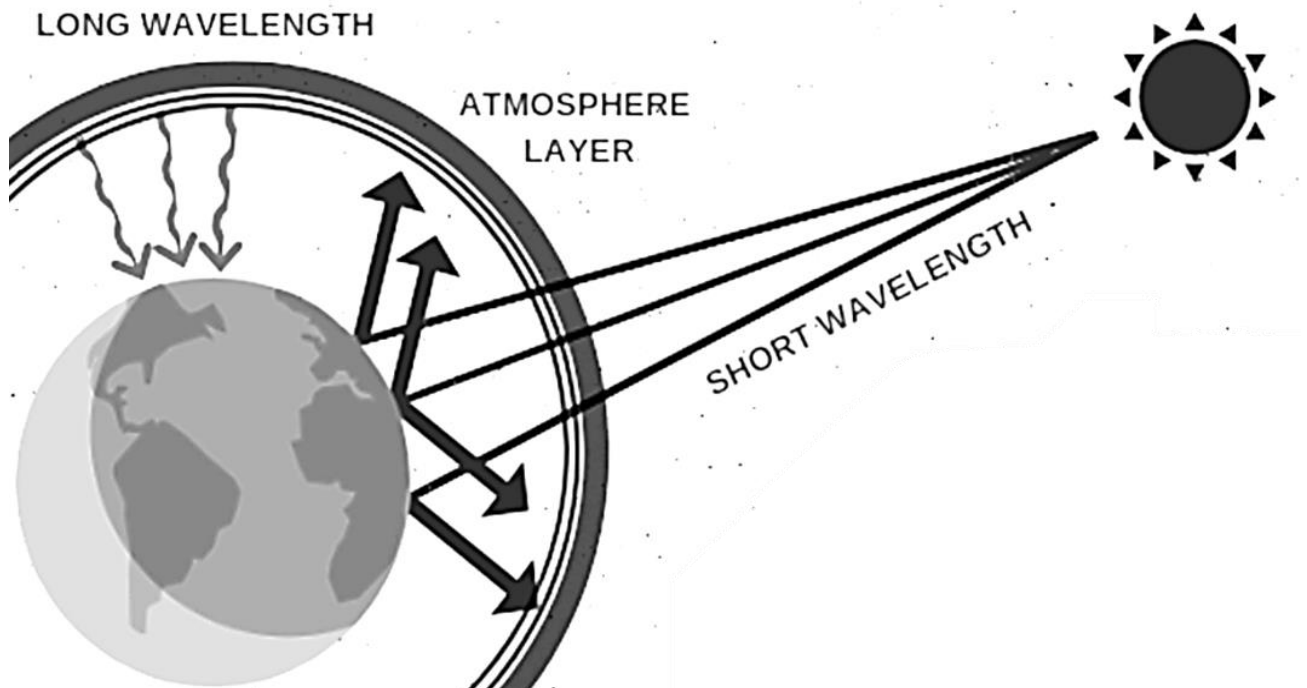
Comparison criterion: length of effect (temporary OR long-lasting)

## Greenhouse effect

### Greenhouse effect

**Greenhouse effect:** natural process where greenhouse gases trap heat in atmosphere

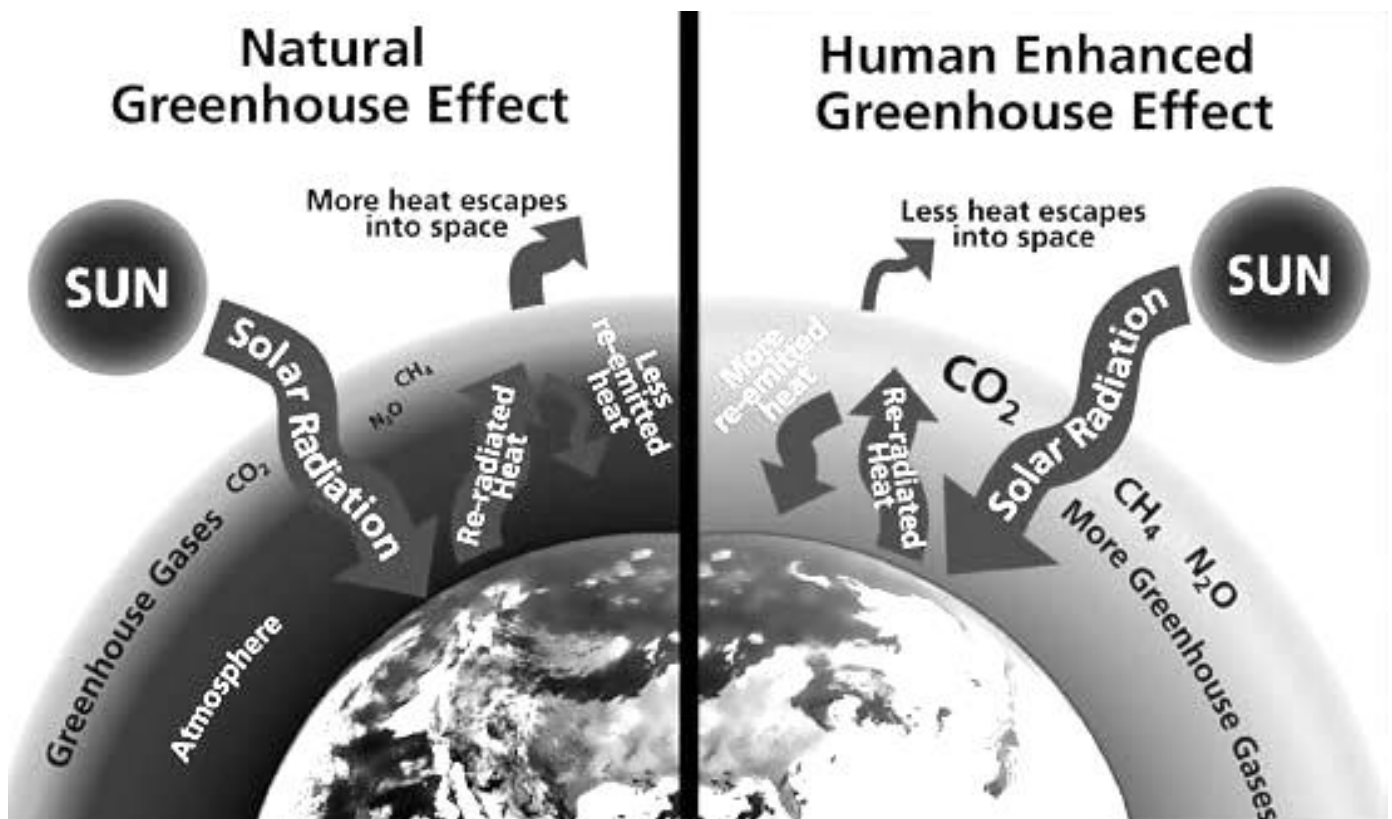
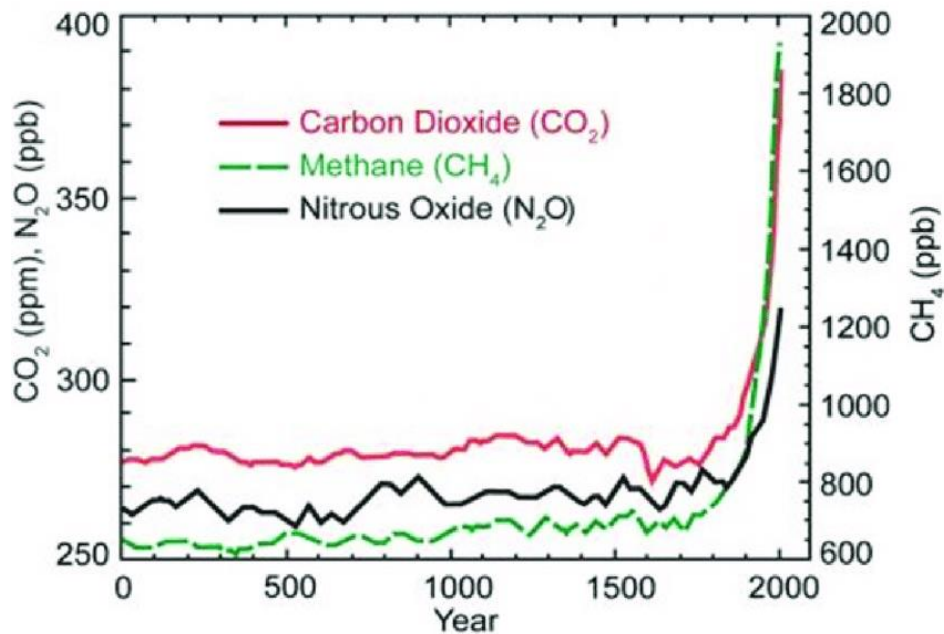
- Process
  1. Shortwave radiation from sun pass through atm
    - Some shortwave radiation: reflected by earth + atm
    - Most shortwave radiation: reflected by earth's surface → heat up
  2. Warmed earth surface emit longwave radiation → atm
  3. Greenhouse gases absorb longwave radiation → warm atm
- **Greenhouse gases:** good absorbers of longwave radiation
  - Absorb longwave radiation → re-radiate in all directions → warm atm
  - Examples
    1. water vapour ( $\text{H}_2\text{O}$ )
    2. **carbon dioxide** ( $\text{CO}_2$ )
    3. **methane** ( $\text{CH}_4$ )
    4. **nitrous oxide** ( $\text{N}_2\text{O}$ )
    5. ozone ( $\text{O}_3$ )
    6. halocarbons (e.g. **chlorofluorocarbons** CFC)



### Enhanced greenhouse effect

**Enhanced greenhouse effect:** increase conc of greenhouse gases in atm → rise in global temp

- Human activities release greenhouse gases > natural emissions
- Conc of greenhouse gases increase since Industrial Revolution
- Most significant increase: carbon dioxide

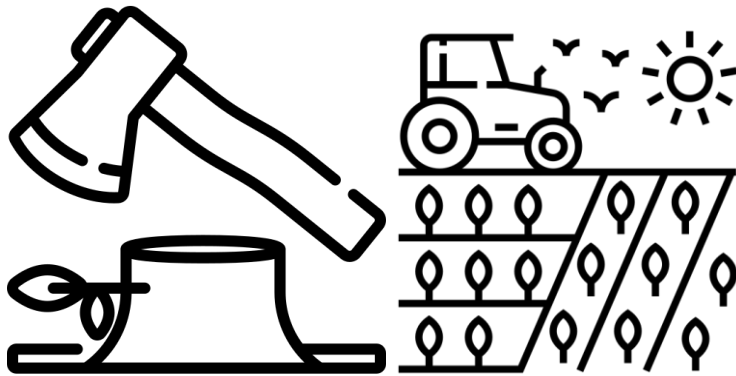


## Human activities leading to enhanced greenhouse effect

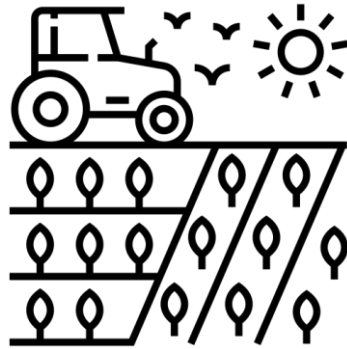
**Anthropogenic factor:** factor caused by human activities

Activity	Explanation	Greenhouse gas
1. <b>Deforestation</b>	<ul style="list-style-type: none"> <li>Remove / clear trees → forests lost               <ol style="list-style-type: none"> <li>make products (paper, building materials)</li> <li>clear land for human activities (mining, agriculture)</li> </ol> </li> <li>Processes               <ol style="list-style-type: none"> <li>Photosynthesis: fewer trees absorb CO<sub>2</sub> → more CO<sub>2</sub> in atmosphere</li> <li>Machinery: emit CO<sub>2</sub> during deforestation &amp; land clearance</li> <li>Burn forests: release CO<sub>2</sub></li> <li><b>Carbon oxidation</b> in soil: carbon in soil reacts with oxygen → carbon dioxide                   <ul style="list-style-type: none"> <li>Soil exposed (decomposition of <u>organic matter</u> → source of carbon)</li> <li>Increase soil temperature → increase rate of carbon oxidation</li> <li>Increase rate of release of CO<sub>2</sub> into atmosphere</li> </ul> </li> </ol> </li> </ul>	CO <sub>2</sub>
2. <b>Agriculture</b>	<p>Practice of cultivating land → crops + livestock</p> <ol style="list-style-type: none"> <li>Crop cultivation           <ul style="list-style-type: none"> <li>Machinery (tractors) run on fossil fuels → CO<sub>2</sub> + N<sub>2</sub>O</li> <li>Inorganic fertilisers (nitrogen-based) → N<sub>2</sub>O (released when soil ploughed / rain flow through soil)</li> <li>Organic matter (dead leaves, manure) decompose → CH<sub>4</sub></li> </ul> </li> <li>Cattle farming           <ul style="list-style-type: none"> <li>Cattle release waste gas → CH<sub>4</sub></li> </ul> </li> </ol>	CO <sub>2</sub> N <sub>2</sub> O CH <sub>4</sub>
3. <b>Industrial activities</b>	<ul style="list-style-type: none"> <li>Production of goods &amp; services</li> <li><b>Secondary industries:</b> industrial economic activities (e.g. manufacturing)           <ul style="list-style-type: none"> <li>Burn fossil fuels → release energy → electricity to operate machinery</li> <li>CO<sub>2</sub> released during production</li> </ul> </li> </ul>	CO <sub>2</sub>
4. <b>Urbanisation</b>	<ul style="list-style-type: none"> <li>More people live in urban areas</li> <li>Burn fossil fuels → energy for human activities</li> </ul>	

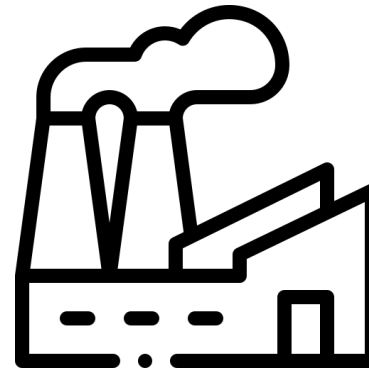
- |  |  |  |
|--|--|--|
|  | <ul style="list-style-type: none"><li>• Examples<ol style="list-style-type: none"><li>1) household activities (electricity → operate electrical appliances)<ol style="list-style-type: none"><li>(a) heating</li><li>(b) cooling</li><li>(c) cooking</li><li>(d) lighting</li></ol></li><li>2) transportation → many vehicles (use more fossil fuels)</li><li>3) construction → construct infrastructure + produce construction materials (machinery use fossil fuels)</li></ol></li></ul> |  |
|--|--|--|



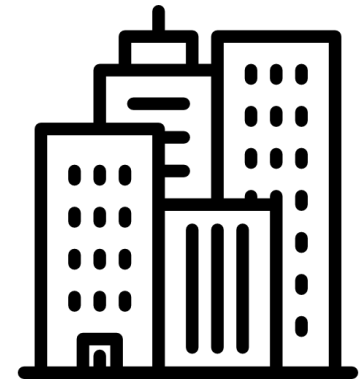
D



A



I



U

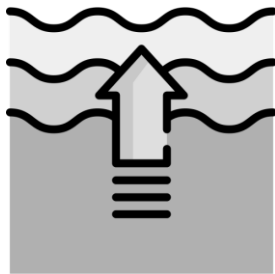
## Effects of climate change

### Impacts

Effect	Explanation	Examples
1. <b>Sea level rise</b>	<ul style="list-style-type: none"> <li>increase in mean height of sea surface between high &amp; low tide, relative to land</li> <li><b>CAUSE:</b> <ol style="list-style-type: none"> <li>glaciers melt (Greenland, Antarctica) → resultant meltwater</li> <li>sea water expand</li> </ol> </li> <li><b>EFFECT:</b> submerge low-lying land (coastal areas, islands) <ol style="list-style-type: none"> <li>lives lost</li> <li>homes lost → move further inland, relocate</li> <li>crops submerged</li> </ol> </li> </ul>	<p><b>Majuro Atoll</b> (Pacific Ocean)</p> <ul style="list-style-type: none"> <li>Lose 80% land if sea level rises by 0.5 m</li> </ul> <p>Places disappear with rising sea levels</p> <ol style="list-style-type: none"> <li>Amsterdam</li> <li>Venice</li> <li>Maldives</li> </ol>
2. <b>More frequent extreme weather events</b>	<ul style="list-style-type: none"> <li>severe + rare weather phenomenon → economic + live loss</li> <li><b>Tropical storms</b></li> <li><b>Heat waves</b> <ul style="list-style-type: none"> <li><b>CAUSE:</b> higher land &amp; sea surface temperature <ul style="list-style-type: none"> <li>warmer atmosphere <ol style="list-style-type: none"> <li>more water vapour</li> <li>more latent heat</li> </ol> </li> <li>powerful driving force for extreme weather events</li> </ul> </li> <li><b>EFFECT:</b> extreme heat → kill people <ul style="list-style-type: none"> <li>body cannot cool down sufficiently → vital organs at risk → death</li> <li>vulnerable: <ol style="list-style-type: none"> <li>young children</li> <li>elderly</li> </ol> </li> </ul> </li> </ul> </li> </ul>	<p>Heat wave in Europe (Aug 2003)</p> <ul style="list-style-type: none"> <li>killed 70,000 people</li> </ul>
3. <b>Spread of</b>	<ul style="list-style-type: none"> <li>Diseases transmitted: insects → humans</li> </ul>	



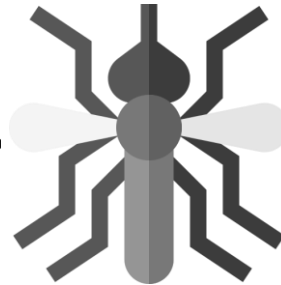
<b>infectious insect-borne diseases</b>	<ul style="list-style-type: none"><li>● <b>CAUSE:</b> stagnant pools of water → breeding spots<ul style="list-style-type: none"><li>○ hotter temperature → more water evaporate</li><li>○ high rainfall</li></ul></li><li>● <b>EFFECT:</b> insects thrive in aquatic habitats (tropical areas)<ul style="list-style-type: none"><li>1) distribution: tropics → temperate regions</li><li>2) health risks</li></ul></li></ul>	<table><tr><th>Malaria</th><th>Dengue fever</th></tr><tr><td>mosquito parasite</td><td>infected mosquito</td></tr><tr><td><ul style="list-style-type: none"><li>● high fever</li><li>● chills</li><li>● flu-like symptoms</li></ul></td><td><ul style="list-style-type: none"><li>● fever</li><li>● headaches</li><li>● severe bleeding</li></ul></td></tr></table> <p><b>Dengue fever</b> (2004) in cool climate areas</p> <ul style="list-style-type: none"><li>1) Nepal</li><li>2) Bhutan</li></ul>	Malaria	Dengue fever	mosquito parasite	infected mosquito	<ul style="list-style-type: none"><li>● high fever</li><li>● chills</li><li>● flu-like symptoms</li></ul>	<ul style="list-style-type: none"><li>● fever</li><li>● headaches</li><li>● severe bleeding</li></ul>									
Malaria	Dengue fever																
mosquito parasite	infected mosquito																
<ul style="list-style-type: none"><li>● high fever</li><li>● chills</li><li>● flu-like symptoms</li></ul>	<ul style="list-style-type: none"><li>● fever</li><li>● headaches</li><li>● severe bleeding</li></ul>																
4. <b>Lengthen growing season</b>	<ul style="list-style-type: none"><li>● Period when crops can be grown</li><li>● <b>CAUSE:</b> weather conditions required to cultivate crops</li><li>● <b>EFFECT:</b> vary from crop to crop</li></ul>	<table><tr><th>Crop</th><th>Country</th><th>Production</th></tr><tr><td>blackberries, maize</td><td>UK</td><td>+</td></tr><tr><td>fruits, soya beans</td><td>Canada</td><td>+</td></tr><tr><td>fruits, nuts</td><td>China</td><td>-</td></tr><tr><td>wheat grain</td><td>Canada</td><td>-</td></tr></table>	Crop	Country	Production	blackberries, maize	UK	+	fruits, soya beans	Canada	+	fruits, nuts	China	-	wheat grain	Canada	-
Crop	Country	Production															
blackberries, maize	UK	+															
fruits, soya beans	Canada	+															
fruits, nuts	China	-															
wheat grain	Canada	-															



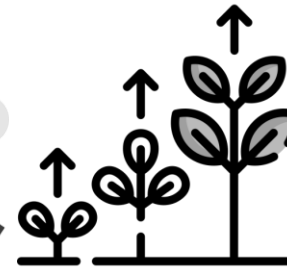
S



E



I



G

## Responses to climate change



### International agreements


Coordinated responses → deal with immense challenge of climate change

Measure	Description	Effectiveness	Limitations
1. <b>Kyoto Protocol</b>	<ul style="list-style-type: none"> <li>• Goal: reduce levels of greenhouse gases in atmosphere</li> <li>• Come up + implement measures</li> <li>• Rules               <ul style="list-style-type: none"> <li>○ Set targets to reduce greenhouse gas emissions (greater responsibility → 37 DC &amp; Europe due to Industrial Revolution)</li> <li>○ reduce emissions by at least 5% below 1990 levels</li> <li>○ Additional responsibilities (help LDC – provide funds)</li> </ul> </li> </ul>	<p>1) ✓ Meet / exceed targets</p> <ul style="list-style-type: none"> <li>• Finland, Iceland, Greece</li> <li>• monitor + report emissions → on track in keeping to targets</li> </ul> <p>2) Sustainable development</p> <ul style="list-style-type: none"> <li>• Clean Development Mechanism (CDM): give Certified Emission Reduction (CER) credits → countries carry out emission-reduction projects in LDC</li> <li>• help DC reduce emissions</li> </ul> <p>Targets both DC &amp; LDC to reduce emissions → achieve success</p>	<p>1) X achieve targets</p> <ul style="list-style-type: none"> <li>• Denmark, Austria, Spain</li> </ul> <p>2) Not compulsory to provide support to other countries</p> <ul style="list-style-type: none"> <li>• low emissions X provide energy-efficient tech to high emissions</li> <li>• X easily achieve targets (China, India)</li> </ul> <p>3) Countries X sign → high emissions</p> <p>Limited impacts on emissions → increase 35% since 1997 (China, India, USA)</p>

### National responses

Specific measures → different places face specific climate-related issues (address more adequately)

Measure	Description	Effectiveness	Limitations
<b>1. SG Green Plan 2012</b>  	<ul style="list-style-type: none"> <li>Launched: Ministry of the Environment</li> <li>Goal: generate 60% energy from natural gas (clean form of energy) → reduce burning of fossil fuels</li> </ul>	<ol style="list-style-type: none"> <li>2010: 79% → exceed target 2021: 95%</li> <li>Compressed natural gas (CNG) → environmentally friendly               <ul style="list-style-type: none"> <li>No. of vehicles increase</li> <li>24-hr refuelling station</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Complex treatment plants (process) &amp; pipelines (transport)</li> <li>Pipelines: high maintenance costs → X large scale               <ul style="list-style-type: none"> <li>laid underground</li> <li>checked regularly for leakage</li> </ul> </li> </ol>
<b>2. Green Mark Scheme</b>  	<ul style="list-style-type: none"> <li>Launched: Building Construction Authority Singapore</li> <li>Goal: evaluate + certify buildings according to ① energy-efficiency ② environmentally friendly               <ul style="list-style-type: none"> <li>encourage more 'green' buildings → energy-efficient (e.g. run on solar energy)</li> <li>promote energy conservation → reduce energy consumption</li> </ul> </li> </ul>	<ol style="list-style-type: none"> <li>450 'green' buildings               <ul style="list-style-type: none"> <li>Examples:                   <ul style="list-style-type: none"> <li>Plaza by the Park</li> <li>Standard Chartered @ Changi</li> <li>National Library Building</li> </ul> </li> <li>energy save: 15 ~ 35%</li> <li>reduce use of fossil fuels to generate electricity → cut down emissions</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Construction companies &amp; developers               <ul style="list-style-type: none"> <li>conservative about adopting new ideas &amp; materials → build 'green' buildings</li> <li>built using processes: environmentally friendly &amp; resource-efficient</li> </ul> </li> <li>Cost more to build               <ul style="list-style-type: none"> <li>'green' materials more expensive &amp; difficult to obtain                   <ul style="list-style-type: none"> <li>bamboo</li> <li>recycled metal</li> </ul> </li> <li>lower profits</li> </ul> </li> </ol> <p>Less 'green' buildings → more fossil fuels burnt to generate electricity → emissions</p>
<b>3. Plant-A-Tree</b>	<ul style="list-style-type: none"> <li>Launched: Garden City Fund &amp;</li> </ul>	1) 60K trees planted yearly by	1) Trees take many years to mature

<p><b>Programme</b></p> 	<p>Singapore Environment Council</p> <ul style="list-style-type: none"> <li>• Goal: maintain SG's status as Garden City by planting trees <ul style="list-style-type: none"> <li>◦ donate money to buy a tree</li> <li>◦ participate in tree planting events (monthly)</li> </ul> </li> </ul>	<p>National Parks Board → remove CO<sub>2</sub> from atm ('green lungs')</p>	<ul style="list-style-type: none"> <li>• <u>X short-term</u> solution → +ve effects take time to materialise</li> <li>• fast-growing trees (angsana, raintree, yellow flame) → 25 years to reach full height</li> </ul> <p>2) Costly + labour-intensive to maintain</p> <ul style="list-style-type: none"> <li>• regular pruning → remove diseased &amp; precarious branches</li> <li>• rainstorm: tress fall → deaths <ul style="list-style-type: none"> <li>◦ Bukit Batok Nature Park</li> <li>◦ Singapore Botanic Garden</li> </ul> </li> </ul>
---	---	--	--

Conclusion: **national > international** (scale + control → implement + enforce)

International	National
<p>Larger <u>scale</u> + difficult to control → difficult to <u>implement + enforce</u> measures</p>	<p>Smaller <u>scale</u> + easy to control → easy to <u>implement + enforce</u> measures</p>
<p>Commitment abandoned when contradicts / hinders country's economic agenda → difficult to ensure effectiveness of agreement</p>	<p>National initiatives communicated to the masses more easily (in the same country) → easy to implement</p>

**Typical questions****Structured questions**

- 1 Explain briefly how **one named** greenhouse gas helps to trap heat in the atmosphere. [4]  
(N2016/P2/Q3a)

One of the greenhouse gases that traps heat in the atmosphere is methane, which is produced by wetlands and the raising of livestock.

- During the day, the Earth's atmosphere reflects some of the shortwave radiation from the sun and allows some of it to pass through. Most of the heat in the form of shortwave radiation that reaches Earth's surface will then be absorbed.
- The Earth's surface, now warmed, emits longwave radiation into the atmosphere.
- Methane gas, like other greenhouse gases, absorbs the longwave radiation, preventing it from being released into the atmosphere. This causes the average temperature in the Earth's atmosphere to increase.

- 2 Explain how volcanic eruptions can have an influence on climate. [4]  
(N2017/P2/Q3a)

The nature of the content released into the atmosphere during volcanic eruptions can influence the climate.

- Explosive eruptions expel huge ash clouds containing sulphur particles and greenhouse gases, such as carbon dioxide.
- Such ash clouds spread over several kilometres in the atmosphere, thereby blocking sunlight and solar radiation. This could then cause a dip in temperature over a period of time after the eruption.
- In some extreme cases, this decrease in the temperature can last for months, such as the eruption of Mount Pinatubo in the Philippines in 2001, which was observed to have caused a cooling of the earth's surface for nearly two years.

- 3 Study the figure below, which shows sea level changes. (Pure N2014/P2/Q2)

- (a) Describe the changes from 1850 to 2010. [4]

- **OVERALL:** Overall, from 1850 to 2010, sea level increased from 0 to 220mm.
- **ABNORMAL:** While the sea level increases, there are fluctuations of about 20 mm.
- **RATE OF CHANGE:** From 1850 to 1930, the increase in sea level is slower, from 0 to 60 mm.

- **RATE OF CHANGE:** From 1930 to 2010, the increase in sea level is faster, from 60 to 220 mm.

(b) Suggest reasons for both the changes and range in the projections of sea levels between 2010 and 2100. [4]

Reasons for increase (change) in sea level: enhanced greenhouse effect (root cause) due to increase in greenhouse gas emissions

- **Deforestation:**

- Fewer trees: Trees are cut down for the building of infrastructure and agricultural purposes. There are fewer trees to absorb carbon dioxide, leading to more carbon dioxide in the atmosphere to trap more heat. This leads to an increase in global temperature.
- Carbon oxidation: When trees are cut down, carbon in the soil is exposed, leading to

- **Urbanisation:** electricity usage → burn fossil fuels → CO<sub>2</sub>

- **Industrial activities:** production / manufacturing → burn fossil fuels to generate electricity for machinery to operate

- **Agriculture:** cattle farming → cows release methane as waste gas. rice → decomposition takes place in water. tractor → run on fossil fuels. inorganic fertiliser

Reasons for range

- bottom line: increase at a constant rate → efforts against climate change
- top line: increase at a faster rate → efforts don't work
- Example of actions (work / din work)

### Open-ended questions

- 4 'Rice cultivation and cattle farming are the most important factors leading to the enhanced greenhouse effect.'

How far do you agree with the statement above? Give evidence to support your answer. [8]  
(N2015/P2/Q3b)

...

To conclude, rice cultivation and cattle ranching are only two contributing factors to the enhanced greenhouse effect. The burning of fossil fuels and deforestation are two other causes. The former (i.e. burning of fossil fuels) is the most significant contributor of greenhouse gases in the atmosphere, especially considering the fact that the energy produced is required in **every country by every person in the world on a daily basis**, as compared to rice and beef, which are mostly consumed **only in certain parts of the world**.

- 5 'The greatest threat posed by climate change is a sea level rise.'

To what extent is this statement true? Give examples to support your answer.

[8]

(N2019/P2/Q3b)

...

In conclusion, sea level rise is the greatest threat posed by climate change. Complex challenges such as sea level rise are **more difficult to manage**, due to the potentially large scale of their impact and measures such as relocating people to higher areas are logistically difficult to implement. This also affects a substantial number of people, resulting in significant economic loss and fatalities. Other challenges such as extreme weather events can be somewhat mitigated, despite their severity, if countries put in place preparedness measures for effective response. Other challenges such as the spread of infectious insect-borne diseases may become more serious if climate change persists in creating favourable conditions for insects to thrive in more countries. Therefore, the statement that the greatest threat posed by climate change is sea level rise is true to a large extent.

- 6 'International responses are the only effective way to deal with climate change.'

How far do you agree with this statement? Use evidence to support your answer. [8]  
(N2017/P2/Q3b)

...

In conclusion, international responses are definitely not the only way to effectively fight climate change, as it involves commitment from as well as agreements among countries. The commitment may be quickly abandoned when it contradicts or hinders the country's economic agenda. At times, different agendas of different countries also pose a **difficulty in ensuring the effectiveness** of the agreement. On the other hand, national policies may sometimes be more effective in dealing with climate change because it is **easier to implement**. Such national initiatives can also be communicated to the masses more easily. Instead of limiting the initiatives to politicians and experts, as in the case of international agreements, national initiatives can also involve the efforts of the masses in fighting climate change.