



ANGLO-CHINESE JUNIOR COLLEGE

JC2 Preliminary Examination

Higher 1

GEOGRAPHY

8834/01

Paper 1

28 August 2025

3 hours

Suggested Answers

Section A

Cluster 2 Fieldwork

- 1 A group of students conducted a fieldwork investigation on the needs of elderly residents in Toa Payoh, Singapore. The focus of their investigation was to assess how well pedestrian pathways and neighbourhood amenities support elderly residents in staying active and independent. The hypothesis for their study was:

‘Pedestrian pathways and the markets in Toa Payoh adequately meet the needs of elderly residents.’

The students conducted the investigation over two weekdays in October, between 9am and 12pm. The students started by firstly doing a pre-fieldwork site visit of Toa Payoh Estate. The main locations selected were a pedestrian pathway in Toa Payoh Central and another in the hawker and market centre.

They then started to collect data by conducting a survey of elderly residents at the two locations. The aim was to gather data on their experiences about the pedestrian pathways and the markets in Toa Payoh. They approached anyone that they thought looked over 60. A total of 40 elderly respondents, aged 60 and above, participated in the survey. They also took photographs of the pathways and the markets in the area.

Resource 1 shows a map of Toa Payoh and the locations of the fieldwork sites. Resource 2 shows photographs of the pedestrian pathways and the market in Toa Payoh. Resource 3 shows the results of the survey about pedestrian pathways. Resource 4 shows the results of the survey about markets in Toa Payoh.

- (a) Explain why this hypothesis is suitable for the investigation. [4]

Marking guidance

Award 1 mark for each explanation of a strength.

Award a maximum of 1 additional mark for further development of each explanation.

Possible responses include:

- The hypothesis is clearly aligned with the aim of the investigation to assess whether pedestrian pathways and markets meet the needs of the elderly. [1]
- It is testable and measurable, since aspects such as pathway condition, shelter, crossings, and market usage can be evaluated through structured surveys. [1] The use of Likert-scale questions in the survey allows quantifiable responses that make the hypothesis operational and evidence-based. [+1]
- It is manageable and realistic for the students to study, since both the pathways and market are confined to specific sites in Toa Payoh, making data collection feasible within two weekdays. [1]
- The hypothesis is contextually relevant, as Toa Payoh has a large elderly population, so investigating their liveability concerns makes the study meaningful. [1]

- (b)** With reference to Resources 1 and 2, suggest how the students could minimise potential impacts at the sites while conducting their investigation. [5]

Award 1 mark for each suggestion of how to minimise potential impacts. Award a maximum of 1 additional mark for further development of each suggestion.

Possible responses include:

- Students should stand at the edges of the pedestrian pathways shown in Resource 2 to avoid obstructing elderly residents using mobility aids [1 mark].
- Students should position themselves away from stall fronts in the market when conducting surveys [1 mark]. This prevents disruption to vendors and keeps circulation aisles clear for shoppers [1 additional mark].
- Students should time approaches respectfully such as speak to seated pedestrians or after shoppers have completed purchases. [1 mark]. This minimises inconvenience to the elderly and shortens interaction time [1 additional mark].
- Students should ensure any trash that they have accumulated should be disposed of correctly. [1 mark] This will reduce the chances of littering and polluting the environment for the other users of the pathways. [1 additional mark]

- (c)** Explain the benefits of conducting a pre-fieldwork site visit of Toa Payoh estate. [4]

Award 1 mark for each benefit of a pre-fieldwork site visit.

Award a maximum of 1 additional mark for further development of each benefit

Possible responses include:

- Students can familiarise themselves with the physical layout of the estate [1 mark]. This helps them identify the most suitable pedestrian pathways and market entrances where elderly residents are concentrated, improving data collection efficiency [1 additional mark].
- Students can refine their data collection methods such as deciding where to stand and how to approach respondents [1 mark]. This reduces confusion during the actual survey and ensures smoother interaction with the elderly [1 additional mark].
- Students can carry out a risk assessment of the sites [1 mark]. This allows them to spot potential safety issues such as crowded aisles or uneven pavements, so they can plan precautions in advance [1 additional mark].

- (d) With reference to Resource 3, describe the results on satisfaction with pedestrian pathways. [3]

Award 1 mark for each description.

Award a maximum of one additional mark for further development of each description, where applicable.

Possible responses include:

Overall, the results were mostly positive, with more elderly residents expressing satisfaction than dissatisfaction [1 mark].

Many respondents felt the pathways were wide enough [1 mark]. For instance, 14 rated +1 and 6 rated +2, compared to 8 at -1 and 2 at -2 [1 additional mark].

However majority felt that there were insufficient resting spots. [1 mark] This can be seen where 7 rated -2 while 9 rated -1 compared to the positive which only had 12 residents responding positively. [1 additional mark]

- (e) Sketch a graph to present the data in Resource 4. [4]



- (f) Evaluate the usefulness of the investigation in helping students understand factors affecting liveability for the elderly living in Toa Payoh. [10]

Possible Approaches

Candidates could first point out that the investigation is useful because it collects quantitative data from Resources 3 and 4. The survey on pathways and markets provides measurable evidence of elderly residents' perceptions, which can be tabulated and compared to show trends. In addition, photographs from Resource 2 are useful as they provide visual context on the condition of the pathways and market environment, helping to verify or illustrate the survey responses.

The investigation also has strengths that increase its usefulness. The focus on two key sites – a pathway and a market – is directly aligned with the hypothesis, and the sample size of 40 elderly respondents is adequate for small-scale fieldwork. Triangulation between survey data and photographs strengthens conclusions, while the use of simple Likert-style scales allows comparisons across different aspects of liveability, such as safety, shelter, and resting spots.

On the other hand, the reliability and accuracy of the data may be questioned. Some elderly respondents may not fully understand the survey questions if these were conducted in English, which could reduce the accuracy of their answers. The presence of a neutral option may also have affected reliability, as respondents could have chosen it to avoid giving a definite opinion rather than expressing a true view. In addition, students relied on convenience sampling by approaching people who looked above 60, which risks misclassification.

Furthermore, reliability is limited because the investigation was conducted only on two weekdays between 9 am and 12 pm. This excludes evening and weekend users, and does not capture variation in conditions during rainy weather or peak shopping periods. The study also covered only one pathway and one market site, which restricts the accuracy of generalising the findings to the whole of Toa Payoh.

Candidates could suggest that additional, more objective data would improve the study's usefulness. For example, measuring pathway width in metres, counting benches, or recording actual waiting times at crossings would provide stronger evidence. Conducting surveys in different languages, and covering different sites and time periods, would also make the investigation more reliable and accurate.

Section B**Cluster 1 Sustainable Future and Climate Change**

Answer **both** questions

- 2** Resource 5 shows the projected waste generation by region from 2016 to 2050. Resource 6 shows a landfill site. Resource 7 shows a slum in Manila, the Philippines.

- (a)** Using Resource 5, compare the waste generation by region from 2016 to 2050. [5]

Award 1 mark for each comparison of waste generation across regions.
Award a maximum of 1 additional mark for further development of each comparison, where applicable.

Possible responses include:

Waste generation increases in all regions between 2016 and 2050, but the rate of growth differs [1 mark]. For example, Sub-Saharan Africa shows much faster growth than high-income countries [1 additional mark].

East Asia & Pacific consistently generates the most waste compared to other regions [1 mark]. It rises from 468 million tonnes in 2016 to 714 million tonnes in 2050, remaining higher than South Asia, Sub-Saharan Africa and Latin America & Caribbean [1 additional mark].

Sub-Saharan Africa grows the fastest relative to other regions [1 mark]. It increases from 174 million tonnes in 2016 to 516 million tonnes by 2050 [1 additional mark].

High-income countries rise slightly compared to all other regions, then level off [1 mark]. For instance, the North America region grows from 289 million tonnes in 2016 to 396 million tonnes in 2050, unlike Sub-Saharan Africa and South Asia which nearly double [1 additional mark].

South Asia and Latin America & Caribbean both increase, but South Asia grows more sharply than Latin America & Caribbean [1 mark]. South Asia rises from 334 million tonnes in 2016 to 661 million tonnes in 2050, while Latin America & Caribbean grows from 231 million tonnes to 369 million tonnes [1 additional mark].

- (b)** Using Resource 6, describe the environmental problems that occur in areas surrounding landfills sites. [3]

Award 1 mark for each description of environmental problems caused by landfills, Award a maximum of 1 additional mark for further development of each description, where applicable.

Possible responses include:

Landfills produce air pollution from foul odours [1 mark].

Landfills can lead to water pollution [1 mark]. Leachate may seep into groundwater or nearby rivers, contaminating water supplies with harmful chemicals and bacteria [1 additional mark].

Landfills cause visual and land degradation [1 mark]. Large piles of waste spoil the landscape and reduce the liveability of nearby settlements [1 additional mark].

- (c)** With the use of examples, explain how cities can manage non-hazardous solid waste. [6]

Award 1 mark for each explanation of how cities manage non-hazardous solid waste.

Award a maximum of 1 additional mark for further development of each explanation, where applicable.

Possible responses include:

Cities can introduce recycling programmes to reduce the amount of waste sent to landfills [1 mark]. For example, Singapore uses a dual system of recycling bins in residential estates and centralised collection, which helps increase recycling rates [1 additional mark].

Waste-to-energy incineration plants can be used to reduce waste volume while generating electricity [1 mark]. In Singapore, the Tuas South Incineration Plant processes thousands of tonnes of waste daily, reducing landfill pressure [1 additional mark].

Cities may implement strict waste segregation at source [1 mark]. For example, Tokyo enforces detailed sorting of burnable, non-burnable, and recyclable waste, ensuring higher recycling efficiency [1 additional mark].

- (d)** With reference to Resource 7, describe the deprivations experienced by slum dwellers. [4]

Award 1 mark for each description of aspects of deprivation experienced by slum dwellers.

Award a maximum of 1 additional mark for further development of each description, where applicable.

Possible responses include:

Slum dwellers face poor housing conditions [1 mark]. Resource 7 shows makeshift houses built from corrugated metal sheets and wood, which provide little protection from weather and are structurally unsafe [1 additional mark].

There is a lack of basic sanitation and waste management [1 mark]. The photograph indicates rubbish strewn across the ground, suggesting uncollected waste and unhygienic living conditions that can cause disease [1 additional mark].

Slum areas suffer from overcrowding [1 mark]. Houses are built very close together in Resource 7, leaving little space for ventilation, privacy, or safe movement [1 additional mark].

Residents experience limited access to clean water and services [1 mark]. The informal nature of the settlement shown implies the absence of piped water, electricity, and proper drainage [1 additional mark].

- (e) Explain the reasons for development of slums in urban areas of countries at lower levels of development. [4]

Award 1 mark for each explanation of why slums develop in urban areas in LDCs. Award a maximum of 1 additional mark for further development of each explanation, where applicable.

Possible responses include:

Rapid rural-urban migration puts pressure on housing supply in cities [1 mark]. Migrants move in search of jobs, but formal housing cannot keep up with demand, leading to informal settlements [1 additional mark].

High poverty levels prevent many new arrivals from affording proper housing [1 mark]. Without sufficient income, families resort to constructing makeshift shelters on vacant land [1 additional mark].

Weak urban planning and governance limit the ability of city authorities to provide adequate housing [1 mark]. Land use controls and building regulations may not be enforced, allowing slums to expand unchecked [1 additional mark].

- 3 Resource 8 shows the extent of Arctic summer sea ice from 1979 to 2024. Resource 9 shows the variations in vulnerability to the impacts of climate change. Resource 10 shows the cumulative share of historical fossil carbon dioxide emissions by continents since 1860.

(a) **With reference to Resource 8, explain the feedback mechanism leading to the changes to the extent of Arctic summer sea ice from 1979 to 2024.** [4]

Possible response include:

With reference to Resource 8, the feedback mechanism leading to the changes in the extent of Arctic summer sea ice from 1979 to 2024 is best explained by the **ice-albedo feedback loop**.

1. **Initial Warming:** The graph "Summer minimum sea ice extent (1979-2024)" clearly shows a **declining trend in observed sea ice extent** over this period, indicating a warming Arctic.
2. **Reduced Albedo:** As global temperatures rise (evidenced by the long-term trend of decreasing ice), the **extent of highly reflective sea ice decreases**. This is visible in the top map, where the September 2024 extent is significantly smaller than the median extents from 1981-2010 and 1991-2020.
3. **Increased Absorption:** Less sea ice means that a larger area of the **darker ocean surface is exposed**. The dark ocean has a **much lower albedo** (reflectivity) than bright ice, meaning it **absorbs more solar radiation** instead of reflecting it.
4. **Amplified Warming:** This increased absorption of solar energy by the ocean leads to **further warming of the ocean water**.
5. **Further Ice Melt:** The warmer ocean water then contributes to **melting even more sea ice**, thus continuing and accelerating the cycle.

This **positive feedback loop** explains the observed overall decline in Arctic summer sea ice extent from 1979 to 2024, as depicted by the downward 'trend' line in Resource 8.

(b) **Using Resource 9, describe the variations in vulnerability to the impacts of climate change.** [4]

Possible responses include

Firstly, the map highlights that **developing regions**, particularly Sub-Saharan Africa, South Asia, and Central America, exhibit the highest vulnerability (151-181 and 121-150). Countries across the African continent, from West Africa (e.g., Nigeria) through Central Africa to East Africa, are predominantly in the highest risk categories. Similarly, countries like India, Pakistan, and Bangladesh in South Asia, along with many island nations in Southeast Asia (e.g., Philippines, Indonesia's northern islands), fall into these most vulnerable bands ranging from 91 - 181.

Secondly, moderately vulnerable regions (91-120 and 61-90) are concentrated in parts of South America (e.g., Brazil, Peru), North Africa and the Middle East (e.g., Algeria, Saudi Arabia), and significant portions of Central Asia (e.g., Kazakhstan, Mongolia), and Southeast Asia (e.g., China).

Conversely, **developed nations** in the Northern Hemisphere and Oceania show the lowest vulnerability (1-30 and 31-60). Specifically, Canada, the United States,

Australia, New Zealand, and most of Western and Northern Europe (e.g., UK, France, Germany, Scandinavia) are largely depicted in the "least at risk" category.

- (c) **With reference to Resource 9, explain why some places are more vulnerable to the impacts of climate change.** [6]

Award two marks for each group of places with different levels of vulnerability.

Possible responses include:

From Resource 9, we can observe that much of **Sub-Saharan Africa, parts of South and Southeast Asia (e.g., India, Southeast Asian islands), and Central America are classified in the "Most at Risk" category (151-181).**

These regions often exhibit **high exposure to climate hazards** such as **prolonged droughts, extreme heat, sea-level rise, and more intense tropical storms**. For instance, **low-lying coastal areas** in Southeast Asia are highly exposed to **rising sea levels and storm surges**, leading to **salinization of agricultural land and displacement**. Inland regions, particularly in Sub-Saharan Africa, are highly sensitive to changes in rainfall patterns, which directly impact **rain-fed agriculture** – a dominant economic activity and food source. Their heavy **reliance on primary sectors** makes them particularly vulnerable to even minor climatic shifts.

Furthermore, countries in these "Most at Risk" categories typically possess **lower adaptive capacities**. This is often due to **lower levels of economic development, limited access to technology, weaker governance structures, and inadequate infrastructure**. For example, countries in Sub-Saharan Africa may **lack the financial resources** to invest in **drought-resistant crops, early warning systems for extreme weather, or robust flood defenses**. **Healthcare systems** might be overwhelmed by climate-related diseases (e.g., malaria in warmer conditions), and **emergency services** may be poorly equipped to respond to widespread disasters. Their ability to **diversify economies** away from climate-sensitive sectors is also limited.

Conversely, **countries like Canada, the United States, Australia, and much of Western Europe are categorized as "Least at Risk" (1-30).** While these nations are also exposed to climate hazards, their vulnerability is significantly reduced by **higher adaptive capacities**. They have **robust economies, advanced technological capabilities, strong governance, and well-developed infrastructure**. This allows them to invest in sophisticated **climate monitoring**, implement effective **disaster preparedness plans**, develop **climate-resilient infrastructure** (e.g., sea walls, advanced irrigation), and provide **social safety nets** for affected populations. Their **diversified economies** are also less sensitive to single climate shocks. For instance, even if a part of the United States experiences a severe drought, its national economic structure and ability to import food reduce its overall sensitivity compared to a country solely reliant on subsistence farming.

Examiner's comments

- CE – conceptual error: GHGs once release in the air is redistributed global wind by the global air or atmospheric circulation. Being near to places with high GHG emission does not lead to high vulnerability to the impact of climate change.
- While it is undeniable that having a high ageing population may make them vulnerable to the impacts of climate change, it is difficult to sieve that out from the given resource. Unless you already have examples of places with a high ageing population, and that they have high vulnerability, it is not a suitable reason for explanation of climate change impact vulnerability globally.

Furthermore, those countries with an ageing population are often developed countries who would usually do quite well in adapting to climate change which lowers their vulnerability.

(d) Explain how Resources 9 and 10 reflect climate injustice.

[4]

Possible responses include

Resources 9 and 10 together strongly reflect the concept of climate injustice, which highlights the unfair distribution of the burdens and benefits associated with climate change. Climate injustice lies in the fact that **those who have contributed the least to the problem (developing nations in Africa, South Asia, etc.) are bearing the greatest burden of climate change impacts.** They face higher risks of droughts, floods, sea-level rise, and extreme weather, exacerbating existing vulnerabilities.

Resource 10, "Cumulative Shares of Historical Fossil CO₂ Emissions," clearly shows that **Europe and North America** are historically responsible for the vast majority of cumulative fossil CO₂ emissions from 1860 to 2023. These regions collectively account for over 80% of emissions for much of the 20th century and still hold a significant cumulative share even as Asia's share has grown more recently. This indicates that a relatively small number of highly industrialized nations have contributed disproportionately to the greenhouse gases currently driving climate change.

In stark contrast, Resource 9, a map reveals that the **regions historically least responsible for cumulative emissions are often the most vulnerable to climate change impacts.** Specifically, Sub-Saharan Africa, South Asia (e.g., India, Pakistan, Bangladesh), and Central America, which have contributed minimal cumulative emissions according to Resource 10 (Africa's and South America's shares remain very small), are predominantly in the "Most at Risk" categories (151-181 and 121-150) in Resource 9.

Conversely, the regions historically most responsible for emissions (Europe and North America) are largely classified as "Least at Risk" (1-30 and 31-60) in Resource 9. **Those who have historically contributed the most to the problem (developed nations in Europe and North America) are demonstrably least vulnerable** due to their greater adaptive capacity, economic resources, and robust infrastructure.

This stark disparity between historical responsibility for emissions and present-day vulnerability to impacts is the core manifestation of climate injustice shown by these two resources.

(e) Describe four adaptation strategies that have been used to reduce vulnerability to the impacts of climate change.

[4]

Possible response

Here are four adaptation strategies used to reduce vulnerability to the impacts of climate change:

1. Developing Drought-Resistant Crops and Agricultural Techniques:

This strategy focuses on ensuring food security in regions experiencing

increased aridity or unpredictable rainfall. Examples include breeding crop varieties that can withstand longer periods without water or higher soil salinity, and implementing water-saving irrigation methods like drip irrigation, rainwater harvesting, or cultivating crops that require less water. For instance, farmers in *semi-arid regions of India* have adopted new millet varieties that mature faster and require less water, reducing their vulnerability to drought-induced food shortages.

Building Sea Defenses and Coastal Protection: To protect low-lying coastal areas and vulnerable populations from rising sea levels and increased storm surges, physical barriers are constructed. This includes building seawalls, dykes, breakwaters, or restoring natural coastal ecosystems like mangrove forests and coral reefs which act as natural buffers. The *Netherlands*, highly vulnerable to sea-level rise, has a sophisticated system of dykes and storm surge barriers (like the *Maeslantkering*) to protect its land. *Bangladesh*, with its vast deltaic regions, is investing in mangrove restoration projects to protect communities from cyclones and coastal erosion. The *Maldives* being low-lying coral islands besides using seawalls to protect against rising sea levels, also uses the construction of new islands at higher elevation eg. the Hulhumalé,

2. **Implementing Early Warning Systems (EWS) for Extreme Weather Events:** These systems provide timely information about impending hazards like tropical cyclones, floods, heatwaves, or droughts, allowing communities to take protective actions. This involves meteorological monitoring, communication networks (e.g., SMS alerts, radio broadcasts), and established evacuation plans. For example, *India's* and *Bangladesh's* cyclone early warning system has significantly reduced fatalities from severe storms by enabling timely evacuations of coastal populations. Similarly, heatwave early warning systems in European cities allow authorities to issue health advisories and set up cooling centres.
3. **Improving Water Management Infrastructure:** This involves strategies to secure water supply during droughts and manage excess water during floods. Examples include constructing new reservoirs or improving existing ones, developing advanced water recycling and desalination plants, and enhancing flood control measures like permeable surfaces in urban areas to reduce runoff, or expanding natural floodplains. *Singapore*, a water-stressed nation, heavily invests in advanced desalination plants and *NEWater* (recycled wastewater) to secure its freshwater supply, making it less vulnerable to changes in regional rainfall patterns. In cities prone to urban flooding, investments in '*sponge city*' initiatives, like those in China, help absorb and manage stormwater.

Section CAnswer **two** questions

- 4** Evaluate the success of strategies in addressing the issues faced by women living in the city. [13]

Possible Approaches

Candidates could approach the question by first identifying the range of issues women face in cities, such as economic inequality, safety concerns, lack of access to public spaces, gender-based violence, and challenges to psychological well-being. They could then evaluate whether strategies have been successful in addressing these issues, making use of examples provided in the notes.

Candidates could evaluate economic strategies such as gender-responsive budgeting, equal pay legislation, and entrepreneurship support. For instance, Rwanda's gender-responsive budgeting has improved women's economic participation, and Iceland's equal pay laws have reduced the pay gap. However, challenges remain in monitoring implementation and tackling occupational segregation, which limits long term success.

Candidates could consider social strategies such as gender-sensitive legislation, education and skill development, and gender mainstreaming in urban planning. The Domestic Violence Act in India shows progress in protecting women's rights, while women's safety audits in Delhi highlight how gender perspectives can shape safer urban environments. However, implementation gaps and persistent cultural norms often undermine effectiveness, limiting how far these strategies transform everyday experiences.

Candidates could also assess psychological well-being strategies, such as providing mental health services, media campaigns, and support services for survivors of violence. For example, Bangladesh's One Stop Crisis Centres show how integrated services can support survivors. However, these often face resource constraints, patchy coverage, and stigma that prevent full accessibility.

Overall, candidates should make an evaluative judgment on the extent to which these strategies have been successful in making cities more liveable for women, highlighting that while progress is evident in legal frameworks and pilot projects, there remain systemic barriers that constrain their effectiveness.

- 5** 'Urban reimagining has been successful in creating more sustainable cities.'

Evaluate this statement.

[13]

Possible Approaches

Candidates could approach the question by making a judgment on the extent to which urban re-imagining strategies contribute to urban sustainability, considering economic, social and environmental dimensions. They could assess whether strategies such as flagship projects, cultural quarters, heritage tourism, and 24-hour cities achieve long-term sustainability or whether they generate new challenges. Case studies such as Singapore's Marina Bay, Liverpool's European Capital of Culture, and Singapore's Chinatown/ Little India can be used to evaluate success

Candidates could first argue that urban re-imaging has promoted economic sustainability. Liverpool's designation as European Capital of Culture (2008) revitalised its waterfront, boosted cultural industries, and attracted investments, leading to job creation. These demonstrate how re-imaging can transform old industrial cities into service-oriented economies, enhancing long-term economic resilience.

Candidates could then highlight social sustainability benefits. Re-imaging has improved liveability by creating more vibrant city centres, expanding recreational opportunities, and revitalising heritage districts. For instance, Singapore's preservation of Chinatown and Little India integrates heritage into modern development, strengthening identity while attracting tourists. Cultural quarters like Liverpool's Tate Museum and Albert Dock enhance civic pride and foster re-urbanisation, drawing people back to the inner city. Such projects suggest that re-imaging can create inclusive, attractive environments that support sustainable urban living.

On the other hand, candidates could critically evaluate limitations to social and environmental sustainability. Rising costs of living and gentrification often displace low-income groups, undermining inclusivity. In Singapore, higher rents in rejuvenated Chinatown forced out traditional trades, raising questions about who benefits. Liverpool's renewal overlooked ethnic minorities, leaving them marginalised in the new city image. Environmentally, flagship projects may increase pollution and energy demand from construction and tourism, while replacing natural spaces with high-end developments. This questions whether urban re-imaging genuinely achieves environmental sustainability.

6 Evaluate the role of state actors in responding to contemporary climate change. [13]

Possible response:

Climate change represents one of the greatest global challenges, demanding action across multiple scales. State actors – national and local governments – play a central role in climate governance through policy, legislation, and international cooperation. Yet, their effectiveness depends on coordination with international organisations, firms, and NGOs. This essay evaluates the role of state actors in climate response, while also comparing their influence relative to other actors.

States are crucial because they possess the **authority to legislate, regulate, and mobilise resources**. Through policy, governments can reduce greenhouse gas (GHG) emissions, promote renewable energy, and regulate industries. For example, **Germany's Green Party** and broader political leadership enabled the "Energiewende" transition. Renewable energy rose from 6.3% of electricity consumption in 2000 to 51.8% in 2023, supported by legislation that phased out nuclear energy and subsidised renewables. This demonstrates the unique power of governments to set binding national frameworks.

States also provide **financial resources** to fund adaptation and mitigation. For instance, national governments can invest in renewable energy infrastructure or coastal protection. In Singapore, the government's **Nationally Determined Contribution (NDC)** under the Paris Agreement includes enhancing energy efficiency and developing carbon markets, which shape domestic and regional strategies. Such measures highlight that state action remains indispensable in meeting global climate targets.

In terms of the adaptation response to climate change both developed and developing countries are state actors although in varying degree of success. Singapore as a state actor is quite effective in adapting to rising sea level and water security using policies on platform levels for new building and structures, and the use of NEWater (recycled water) and seawater desalination.

Maldives while being a developing country, has made strong adaptation responses in the form of seawalls and artificial islands (eg. Hulhumale) in responding to the impacts of rising sea level and her own low-lying land constraints.

Beyond domestic policy, states are central to **international agreements**. The **Paris Agreement (2015)**, built on state-led NDCs, illustrates how collective state action sets global goals. Governments negotiate at annual COPs, translating commitments into national strategies. Importantly, NDCs must be revised every five years to become increasingly ambitious, showing how states anchor long-term progress.

However, states vary in political will and capacity. While Germany has advanced renewable energy, other states, such as oil-dependent countries, remain reluctant to commit to strong decarbonisation. Thus, although states are critical, their responses are uneven, limiting collective progress.

Despite their importance, state responses often face **constraints**. Political cycles and vested interests can stall ambitious policies. For instance, while the United States played a leading role in shaping the Paris Agreement, the Trump administration's withdrawal in 2017, and a second withdrawal in 2024 revealed how domestic politics can undermine international cooperation. Similarly, developing countries may lack financial resources, reducing their ability to meet ambitious targets without external support. Germany is an example of how state powers may be constrained by the social factor where the citizens are largely against the use of nuclear power, and the German government had no choice and eventually shut down the last nuclear power station in April 2023.

Moreover, **state-led policies alone cannot achieve transformative change**. Climate change is a cross-cutting issue, requiring technological innovation and grassroots mobilisation that extend beyond governmental control. This creates space for other actors to complement or challenge state action.

International organisations like the **UNFCCC and IPCC** coordinate frameworks and provide scientific assessments, but their effectiveness depends on states adopting and implementing recommendations. NGOs such as **Greenpeace** and **WWF** are powerful in advocacy, raising awareness, and mobilising civil society. Greenpeace's legal campaigns against Arctic oil drilling exemplify how NGOs hold governments accountable for environmental harm. However, NGOs lack enforcement power, meaning their influence is indirect.

Firms are increasingly significant, especially in **innovation and green investment**. Companies such as **Google**, which aims for carbon-free energy by 2030, or **Unilever's Sustainable Living Plan**, demonstrate private leadership in reducing emissions. Yet, these actions often occur within the policy frameworks established by states. Corporate sustainability is encouraged through legislation, subsidies, or carbon pricing, again reflecting the enabling role of governments.

Crucially, partnerships between states and other actors amplify effectiveness. For instance, **public-private partnerships in renewable energy** have lowered costs globally, while collaborations between WWF and firms like IKEA demonstrate how NGOs

and businesses complement governmental policy. States alone cannot mobilise the scale of finance and innovation required, but without state-led regulation and legitimacy, other actors' efforts remain fragmented.

State actors are indispensable in responding to climate change because they provide **legislation, resources, and legitimacy**. Their ability to set binding targets and represent citizens at international forums makes them the backbone of climate governance. However, their responses are often constrained by domestic politics, limited resources, and uneven ambition. Other actors – international organisations, NGOs, and firms – play critical supporting roles, providing expertise, advocacy, and innovation. Ultimately, while state actors remain central, effective climate response requires **collaborative governance** that integrates state action with the dynamism of non-state actors. Thus, the role of states is necessary but not sufficient, highlighting the need for partnership-based approaches to tackle the complexity of contemporary climate change.