

2125/02/S/O/25

1 (a) (i) What type of sampling method did the students use? [1]

- The students used **convenience sampling**, as they surveyed people who were easily accessible/ the first person exiting the parks at the time they were present.

(ii) What type of questions are used in the questionnaire? [1]

- **Closed-ended questions** with pre-defined responses.

(iii) State one advantage of using a questionnaire as shown in Fig. 1.1. [1]

- A questionnaire allows for the collection of **quantitative data** from a large number of respondents in a short time, enabling **consistent and comparable analysis**.

(iv) Complete the empty cell on Table 1.1 by calculating the monthly percentage of visitors to Yishun Neighbourhood Park. [1]

- 21%

(v) Using evidence from Tables 1.2 and 1.3, explain why you would agree with the hypothesis. [4]

Reasons are different:

- In Bukit Timah, more people focus on solitude and immersion in a **natural, tranquil setting** such as *walking/hiking (65%), to be with nature (49%) and escape from the city (32%)*. [1]
- In contrast, respondents at Yishun Park visit more for **social and recreational reasons**, such as *spending time with family (60%) and meeting others (32%)*. [1]

Experiences are similar:

- Despite differing purposes, visitors report **similar positive experiences**. For example, *happiness* was high in both with 60% for Bukit Timah and 57% for Yishun). [1]
- *Appreciation of nature* is also comparable with 53% at Bukit Timah and 50% at Yishun). [1]
- *Physical well-being* percentages were almost the same too at 30% and 29% respectively. [1]

(vi) Evaluate the reliability of the data collection method used in this investigation. [4]

Reliable:

- The use of a **structured closed ended questionnaire** ensures consistency in the questions asked, improving **reliability** when comparing data across locations. [1]
- Conducting **20 surveys per day** over several days increases sample size, enhancing the **representativeness** of the data. [1]

Unreliable:

- The use of **convenience sampling** to approach the first 20 people they meet may limit the reliability of data as it **does not ensure a representative sample** of all park users. [1]
- The use of **closed-ended questions** to gather data, with no “others” option in all questions, may prevent respondents from elaborating on their experiences or other motivations, limiting the **qualitative depth** and overall reliability of the investigation. [1]

(b) With reference to Fig. 1.2, suggest **two** regulating ecosystem services provided by Bukit Timah Nature Reserve. [2]

- The thick forest canopy filters airborne pollutants, providing **cleaner air** to surrounding urban areas, contributing to improved **atmospheric regulation**. [1]
- The dense tropical forest **captures and stores atmospheric carbon dioxide**, contributing to the reduction of greenhouse gases/ mitigation of climate change through **carbon regulation**. [1]

(c) (i) Using Fig. 1.3, describe the trends in air quality in Singapore from 2011 to 2020. [4]

- The percentage of ‘Good’ air quality days **declined sharply** from more than 90% between the years 2011 and 2013, to less than 20% across the years from 2014 to 2020. [1]
- ‘Moderate’ air quality days **increased significantly**, becoming the **dominant category** from 2016 onwards. [1]
- **Spikes in ‘Unhealthy’ days are inconsistent** across the years, with most years at less than 5% and an anomaly of around 12% in 2015. [1]
- Days with ‘**Hazardous**’ air quality **were rare or absent** across all years. [1]

(ii) Describe **two** causes of air pollution in urban neighbourhoods. [2]

- In urban neighbourhoods, the **high number of private vehicles and public transport emit pollutants** such as nitrogen dioxide and carbon monoxide, especially during peak hour traffic. [1]
- **Factories release smoke and pollutants** such as sulphur dioxide during manufacturing processes, especially in **mixed-use or industrial estates near residential areas**. [1]
- **Construction activities** in urban neighbourhood can contribute to air pollution as **dust and particulates are generated from construction sites** due to activities like drilling, demolition, and transport of materials. [1]

(iii) Explain the problems air pollution may cause for people living in urban neighbourhoods. [3]

- Air pollution can lead to **serious health problems** for urban residents, especially the elderly and children, as long-term exposure to pollutants can **increase the risk of respiratory illnesses** such as asthma, bronchitis, and even cardiovascular diseases. [1]
- Prolonged poor air quality may also discourage people from engaging in **outdoor physical and social activities**, reducing their overall **quality of life and emotional well-being**. [1]
- The health impacts of air pollution can lead to **increased healthcare costs** and time off work or school, which places a financial strain on families and reduces **economic productivity** in the long term. [1]

(iv) With reference to Fig. 1.4, suggest how environmental and social sustainability may be achieved by the new urban neighbourhood. [2]

- Environmental sustainability can be achieved through the **integration of green infrastructure**, such as rooftop gardens and tree-lined walkways. These features help to **reduce the urban heat island effect, improve air quality**, and promote **biodiversity** in the built environment. [1]
- Social sustainability can be supported by designing **inclusive communal spaces**, such as playgrounds and sheltered walkways, which encourage **social interaction** among residents and improve **quality of life** by fostering a sense of community and belonging. [1]

- 2 (a) (i) Using Fig. 2.1, describe the distribution of areas with a tropical monsoon climate. [3]
- Areas with a tropical monsoon climate are generally found within the tropical region, **between the Tropic of Cancer and Tropic of Capricorn**. [1]
 - These regions include countries in **South and Southeast Asia**, such as India, Thailand, and Vietnam. [1]
 - These regions are also found in **central and southeast Africa, northeastern South America, and northern Australia**, showing a discontinuous and concentrated distribution in coastal and low-latitude areas. [1]
- (ii) During which months does the Northeast monsoon take place? [1]
- **October to February**
- (iii) With reference to Fig. 2.2, explain why Singapore and Malaysia receive high rainfall during the Northeast monsoon season. [4]
- During the Northeast monsoon season from October to February, **winter conditions in the Northern Hemisphere** lead to the formation of a **high-pressure zone**. [1]
 - Since the air moves from a region of higher to lower pressure, the **cool and dry air from Central Asia moves southwards** over the Asian continent. [1]
 - As the dry winds travel over the **South China Sea**, it picks up **large amounts of moisture** through evaporation. [1]
 - Once the moisture-laden winds reaches the **eastern coastal regions of Singapore and Malaysia**, the **moisture is deposited** as rain. Thus, giving rise to the high rainfall conditions. [1]
- (b) Using Fig. 2.3, describe the relationship between temperature and relative humidity. [3]
- There is an **inverse relationship** between temperature and relative humidity. As temperature increases, relative humidity tends to decrease, **vice versa**. [1]
 - Between **6 am and 3 pm**, temperature rises from approximately **26°C to a peak of 33°C**, while relative humidity falls sharply from about **90% to 55%**. [1]
 - After **3 pm**, as temperature gradually decreases from **33°C to 27°C by midnight**, the relative humidity begins to rise again from **55% to around 80%**. [1]

(c) Using Fig. 2.4, describe the pattern of global risk to climate change. [3]

- The **highest risk** areas are mainly located in **Sub-Saharan Africa**, especially in **Central and Eastern Africa**, and parts of **South and Southeast Asia** such as Indonesia and Papua New Guinea. [1]
- Regions with **medium to high risk** are found in parts of **South America**, such as Brazil and Peru, as well as parts of **South Asia**, such as India and Bangladesh. [1]
- The **lowest risk** areas are concentrated in the **higher latitude regions** of North America, Europe, Asia, South America and Oceania. [1]

(d) With reference to Fig. 2.5, explain **three** ways to build a community's resilience to climate change. [3]

1. Reducing carbon emissions from power generation helps **slow down the rate of climate change** by **limiting the release of greenhouse gases** like carbon dioxide, giving communities more time and capacity to adapt and implement long-term protective measures. [1]
2. Improving energy efficiency allows communities to **use less energy** for the same output, **lowering environmental impact from the burning of fossil fuels**, and conserving resources which enhances a community's **ability to adapt sustainably to a changing climate**. [1]
3. Encouraging community cooperation **raises awareness and promotes sustainable practices** such as recycling, water conservation, and responsible consumption, helping to **build collective resilience**. [1]

(e) Explain how the use of technology in food production can build a community's resilience to climate change. [2]

- The use of **climate-resilient agricultural technologies**, such as **drought-resistant crops** and **automated irrigation systems**, helps maintain food supply even during extreme weather conditions. [1]
- Technologies like **precision farming** and **vertical farming** enable efficient use of land and water, ensuring consistent food production and reducing vulnerability to climate-related crop failures. [1]

(f) 'The indirect impacts of increasing temperatures due to climate change on human systems can be as damaging as the direct impacts.'

To what extent do you agree with this statement? Explain your answer. [6]

Agree: Indirect impacts are as damaging

- Indirect impacts of increasing temperatures can severely disrupt human systems such as health, food security, and migration.
- Rising global temperatures can alter rainfall patterns, reduce crop yields, and increase the prevalence of vector-borne diseases like dengue or

malaria. These changes **threaten food supply**, raise healthcare burdens, and worsen social inequalities, especially in **developing countries** with limited resources.

- For example, in **Sub-Saharan Africa**, prolonged droughts linked to higher temperatures have caused widespread crop failures, leading to malnutrition and displacement.
- Similarly, in **South Asia**, hotter climates have expanded the habitat range of mosquitoes, increasing disease transmission in densely populated cities.
- These **indirect impacts can be long-lasting and systemic**, destabilising societies over time and placing **persistent strain on human systems**, making them just as damaging as direct climate events.

Counterpoint: Direct impacts may be more severe

- However, the **direct impacts** of climate change, such as extreme weather events, often cause **immediate, large-scale destruction** to human lives and infrastructure.
- Natural disasters like floods, wildfires, and tropical cyclones, intensified by global warming, lead to direct loss of life, destruction of homes, and collapse of public services. These events can overwhelm communities, especially when they occur suddenly and repeatedly.
- For instance, in **the Philippines**, Typhoon Haiyan (2013) displaced over **4 million people** and caused over **US\$5 billion** in damages.
- Similarly, **Europe's 2022 heatwave** led to **over 60,000 heat-related deaths**, showing the severe health risks of direct temperature rise.
- Thus, direct climate impacts can have **immediate and catastrophic consequences**, particularly in urbanised or low-lying regions, making them highly damaging in both human and economic terms.

Conclusion

- **I agree to a large extent** that **indirect impacts** of rising temperatures can be as damaging as direct impacts because they **undermine the long-term resilience of human systems**, leading to **prolonged crises** that are harder to manage and recover from.

- 3 (a) (i) With reference to Fig. 3.1, name the process where oceanic plates move apart. [1]

- **Seafloor spreading**

- (ii) Using Fig. 3.1, describe the age of rocks with distance from the Mid-Atlantic Ridge. [3]

- As the **distance from the ridge increases**, the rocks become **progressively older**, changing colour from red to yellow to green to blue, indicating increasing age. [1]
- The rocks are **youngest** when they are **within 1000km** from the Mid-Atlantic Ridge. [1]
- The rocks are **oldest** when they are **more than 2000km** from the Mid-Atlantic Ridge. [1]

- There is a **symmetrical pattern of increasing rock age** on **both sides** of the Mid-Atlantic Ridge. [1]
- (b) (i) Using Fig. 3.2, describe the distribution of earthquakes in Africa and the surrounding oceans between 1900 and 2017. [3]
- Earthquakes are mostly **distributed in a linear manner**, [1]
 - such as a **linear band of earthquakes** is found in the middle of the Atlantic Ocean/ **along the Mid-Atlantic Ridge** located offshore from the west of Africa. [1]
 - As well as a high concentration of earthquakes **along the East African Rift Valley**, located around 1000km from the eastern coast of Africa. [1]
 - There is also a high concentration of earthquakes arranged linearly and **stretching from the Indian Ocean in the northeast** down towards the **Southern Ocean in the southwest**. [1]
- (ii) Using Fig. 3.3, explain the location of earthquakes shown in Fig. 3.2. [2]
- Earthquakes are distributed in a **linear manner along plate boundaries** due to **tectonic processes**, where plates interact and create intense **friction and stress** in the lithosphere, resulting in the **sudden release of seismic energy** as earthquakes. [1]
 - In the **East African Rift Valley and Red Sea region**, earthquakes occur where plates such as the **Nubian and Somali Plates** of the African Plate, as well as the **African and Arabian Plates** diverge from each other, causing the crust to **fracture and form faults**, generating **shallow-focus earthquakes**. [1]
 - Earthquakes are also located along the **northwestern part of the African Plate**, including areas near the **Mediterranean Sea**, where **tectonic plates slide past each other**, producing earthquakes as the **built up pressure along fault lines which is released as seismic energy**. [1]
- (c) Explain how a rift valley is formed. [3]
- A **rift valley is formed at a divergent plate boundary**, where **two continental plates move away from each other** due to tensional forces within the crust. [1]
 - As the plates diverge, the **crust is pulled apart**, leading to the formation of **fault lines**. [1]
 - As the landmass between two **parallel faults** sinks due to the tension, a long linear depression known as a **rift valley is formed**. [1]

(ii) Explain how an earthquake is formed at a transform plate boundary. [3]

- At a transform plate boundary, two tectonic plates **slide past each other**, exerting **friction**. [1 mark]
- As the plates try to move, friction causes **stress and pressure to accumulate** at the fault line. [1 mark]
- When the **stress exceeds the frictional force**, the plates **slip suddenly**, releasing stored energy in the form of **seismic waves**, resulting in an earthquake. [1 mark]

(d) With reference to Fig. 3.4, explain how earthquake hazards could have caused this impact. [3]

- **Strong ground shaking** caused by the sudden release of seismic waves during an earthquake, [1] may have **weakened the foundation of buildings**, as seen in the image. [1]
- Secondary hazards like **soil liquefaction** can cause saturated loose soil to lose its soil structure and move like liquid, [1] causing buildings in Fig. 3.4 to **sink in and tip over**. [1]

(e) With reference to Fig. 3.5, explain **three** ways in which communities' resilience to earthquakes could be strengthened. [3]

- By **making a plan**, it strengthens community resilience by **enabling organised responses**, such as allowing families to reunite and communicate during an emergency, **reducing panic and confusion**. [1]
- By encouraging everyone to **secure their homes** through earthquake-proofing actions, it can help **prevent injuries and reduce property damage** during ground shaking, **improving the safety and preparedness of individuals and the wider community**. [1]
- **Staying connected** by getting to know neighbours and listening to radio/media updates **improves information flow and social cohesion**, which enables communities to **respond quickly, support each other, and recover faster**, which enhances overall resilience to earthquake hazards. [1]

(f) "The main advantage of living near a volcano is the benefits gained from the tourist industry."

To what extent do you agree with this statement? Explain your answer. [6]

Agree: The tourist industry is a key advantage of living near volcanoes

- One main benefit of living near a volcano is the revenue generated from tourism, which boosts local economies.
- For example, the ancient Roman city of **Pompeii**, buried by the eruption of **Mount Vesuvius in AD 79**, attracts over **3 million tourists annually**. The preserved ruins provide a unique archaeological site that generates millions in tourism revenue for Italy each year.
- This tourism industry **creates employment** in hotels, restaurants, and heritage management, while also funding local infrastructure development.
- Local residents also benefit from **improved services and higher economic activity**.
- Therefore, the ability of volcanoes to attract global tourism makes the tourist industry a major advantage of living near volcanic areas.

Counterpoint: Fertile volcanic soil can also be a benefit

- Another key benefit is the **fertile volcanic soil**, which enhances agricultural productivity.
- In **Indonesia**, areas around volcanoes such as **Mount Merapi** and **Mount Bromo** have rich andosol soils formed from weathered volcanic ash, supporting crops like rice, vegetables, and tobacco.
- The fertile land sustains livelihoods and food production for many rural communities, especially in densely populated islands like **Java**, where over **145 million people** live.
- Therefore, the agricultural benefits of living near volcanoes are substantial, especially in regions like Indonesia where farming is a key source of income.

Counterpoint: Volcanic regions provide access to geothermal energy

- One more advantage of living near volcanoes is the availability of **geothermal energy**, which offers a clean and sustainable power supply.
- For instance, **Iceland**, which lies on the Mid-Atlantic Ridge, derives about **90% of its homes' heating needs** from geothermal sources, reducing dependence on fossil fuels.
- Similarly, **Indonesia**, located on the Pacific Ring of Fire, is the **world's second-largest geothermal energy producer**, with plans to expand its capacity to **9.3 GW by 2035**.
- Geothermal energy provides affordable and reliable electricity for nearby communities and industries, reduces carbon emissions, and supports green economic development.
- Thus, access to geothermal energy from volcanic activity presents a long-term environmental and economic benefit for residents living near volcanoes.

Conclusion:

I agree to a **large extent** that the **main advantage of living near a volcano lies in the benefits gained from the tourist industry**, especially for countries where tourism forms a substantial part of the economy. The **economic benefits are long-term and sustainable**, as tourism linked to volcanic landscapes and cultural heritage continues to grow globally.