Question 1

(a)	Suggest a plan detailing how students managed to collect the data provided in Resource 1, 2 and 3.	[8]
	1. **Groups and venues** Students could organise themselves into teams, each team will be assigned to a specific venue, select a few suitable housing estates for instance a mature estate with more elderly and a newer estate with more future elderly residents. In the neighbourhoods specifically, they will choose a suitable public spot to find the specific residents to do the job. 2. **Sample Size:** The students should conduct the surveys with the residents each student should at least do 10 surveys with random elderly/future elderly residents. This is to ensure that the sample size of the survey (total 120 surveys) would be sufficient for data analysis. At each estate the number of surveys should be equal for fairness in terms of comparison by sample size. 3. **Timing of the survey:** Students should ideally consider the timings that would allow them to have enough respondents to complete their surveys. Students need to choose wisely their timings (e.g. weekday or weekend) to collect sufficient data. For instance maybe, 3 shifts per day at select timings (peak or non-peak hours), where there are more human traffic to be able to have sufficient respondents. 4. **Survey questions** Students should design a short survey with a few questions asking respondents about their interaction levels. The survey should be short in MCQ or short answer questions, so that respondents would be willingly to participate, as it doesn't take up too much of their time.	
(b)	Explain how Resource 1, 2 and 3 can help the students understand more about the needs of the elderly in Singapore.	[6]
	• Resource 1 shows the level of community participation levels of the elderly, beyond physical infrastructure, it is important to know the social dimensions of the need of the elderly. Data suggest that most of the elderly have low levels of community participation, so more could be done to encourage community participation.	

		• Resource 2 shows the reasons why the elderly are not participating in community activities. Resource 1 shows the data but not the reasons behind it so, resource 2 will provide the reasons behind it. • Resource 3 looks at the frequency with which elderly meet with the elderly. This could help us understand how socially integrated the elderly are and their social connections. Their living arrangement could also be inferred from this. • All 3 resources provide us an understanding to the social aspects of the needs of the elderly.	
(c)	Identify the data representation method in Resource 3 and state its usefulness and limitations.	[3]
	Bar Graph **Usefulness:** • Bar graphs are visually easy to understand, indicating the % clearly. • It also shows 2 categories of elderly and future elderly able to compare future generations. • Shows clearly the percentages accordingly. **Limitations:** • We do not know the sample size of participants for the survey	
(d)	Suggest and justify another data representation method to showcase data in Resource 2.	(d)
	Piechart **Advantages** • display relative proportions of multiple classes of data • size of the circle can be made proportional to the total quantity it represents • summarize a large data set in visual form • be visually simpler than other types of graphs • permit a visual check of the reasonableness or accuracy of calculations • require minimal additional explanation • be easily understood due to widespread use in business and the media **Bar-graph**	

	Advantages • show each data category in a frequency distribution • display relative numbers or proportions of multiple categories • summarize a large data set in visual form • clarify trends better than do tables • estimate key values at a glance • permit a visual check of the accuracy and reasonableness of calculations be easily understood due to widespread use in business and the media	
(e)	Identify some obstacles that students would face during the data collection process.	[3]
	• Elderly might not want to participate in the interview either due to lack of interest or fear of privacy. Care-takers might not want the elderly to participate. • Language issues such as the elderly only know dialect that the surveyors might not understand or able to translate. • Health issues such as the elderly being hard of hearing or having dementia which might affect accuracy of data.	

Question 2

(a)	Using Resource 1 and 2, compare the rainfall and temperature characteristics of Mangalore, India and Iquitos, Peru.	[6]

	Similarities →
	    Low annual range in temperature for both locations though Mangalore slightly higher. Iquitos is about 1 degrees and Mangalore is about 3 degrees
	    High average annual temperatures exceeding 25 degrees Celsius. Iquitos at 26.7 degrees and Mangalore at 27.9 degrees
	
	    High annual rainfall for both locations. Iquitos at 2865mm and Mangalore at 3200mm
	
	Differences →
	    Rainfall is rather consistent for Iquitos ranging from 160mm in July to 325mm in March (no distinct dry season).
	
	    Rainfall is rather uneven for Mangalore (ranging from 0mm in January and February to 1000mm in July.	

		Highest peak rainfall for Mangalore is much higher than peak rainfall of Iquitos (1000mm versus 325mm)	
(b)		Using Resource 1, 3 and your own knowledge, account for the precipitation pattern for Mangalore, India.	[6]
		For this question, explain the seasonal changes of the monsoon with changes in the ITCZ in January and July. NE monsoon → Drier as ITCZ shifts south during northern hemisphere winter High pressure in Northern Hemisphere → Dry continental air blows from Asian continent from the Siberian high → Dry conditions. In July, SW monsoon ITCZ shifts north, South west monsoonal winds blow across the Indian ocean towards Asian landmass (Asiatic low) due to strong solar heating and resulting in low surface pressure over Asian landmass → Brings moisture as the winds pick up moisture from the Indian ocean → Wet conditions Mangalore is also near the coast near the Western Ghats (If students know though not necessary) → Mountain barriers facilitate the trapping of precipitation along the windward coastal area near where Mangalore is located → High precipitation results.	
(c)		Using Resource 1 and Resource 3, explain how flood risk in Mangalore may differ in December and in July.	[4]
		December lower flood risk → Drier conditions → Lower discharge levels → Within bankfull discharge levels July Higher flood risk → High intense precipitation above 1000mm → Saturated soil conditions, higher discharge levels → Exceed bankfull discharge levels → Higher flood risk	
(d)		Imagine you are working for the Flood management authorities in India, suggest a plan which you can advise the authorities to reduce the impacts of flooding in Mangalore based on information in Resource 1 and Resource 3.	(9)
		Indicative content: For this Question, can make use of points studied in flood management such as hard and soft management measures and also flood warning systems. Any 4 points well explained. Plan can include at least 3 points from the various management strategies from Prediction, Mitigation and Response: - Flood and rain warning systems	

- Recurrence interval (but not recommended unless records are kept (difficult to predict due to erratic weather these days)
- Flood risk and hazard mapping
- Satellite imaging and terrain mapping (to determine low lying and high risk areas)
- Flood risk planning (If possible reduce building in flood prone areas or if need to build must have good drainage and pumps to manage areas)
- Hard measures such as flood guard, watertight encasement, building of settlements on higher stilts may reduce damages cause by floods
- Others may also include channelization measures to reduce risk of flooding
- If all else fails, need to have contingency plans to deal with floods such as disaster relief, resettlement
- In urban areas may also need to clear and improve drainage and add pumps to prevent pluvial floods

** Note: Students are to talk about how these measures can help the authorities achieve planning objectives of reducing flooding impacts. Please DO NOT talk about limitations in this aspect.

L3 7-9	• Analytical and explanatory. • Clear focus of question. • Relevant knowledge and good use of examples.
L2 4-6	• Response includes analysis & explanation. • Weaker responses tend to more descriptive. • Generally well organised and structured but could be unclear at some parts. • Use of terms mostly accurate.
L1 1-3	• Response does not really address the question fully • Depth of knowledge and understanding is limited. • Response is fragmentary and lacks a clear structure and organisation • Unsupported, brief or incomplete assertions and/or arguments with some inaccurate use of terminology.

Question 3

(a)	With reference to Resource 1, describe the global distribution of water scarcity issues.	[4]
	Economic water scarcity → Mainly found in central and Southern parts of Africa, Southern parts of Asia, Southern central America and North western parts of South America Physical water scarcity → Central and Western Asia + Middle East, Southeast Australia, South Africa and North Africa. Also found in Central North America Approaching water scarcity → Madagascar, Eastern Europe, central Asia, central America + Eastern South America Little or no water scarcity → North Asia, Large parts of Europe, North America and Large parts of South America	
(b)	Using Resource 1, explain the difference between economic and physical water scarcity.	[2]
	Absolute Water Scarcity → More than 75% of river runoff extracted for agriculture and human use. i.e. Physical shortage in resource Economic water scarcity → Less than 25% of river runoff extracted for agriculture and human use. Can also arise as a result of inability to tap on resource due to limited infrastructure or water is too polluted for human use. Area usually have plentiful resource.	
(c)	Using Resource 2 and your own knowledge, describe and explain why water withdrawal ratios vary between different parts of the world.	[8]
	Indicative content: Agriculture withdrawal ratios highest in Asia and Africa at 81% and 82% respectively → Large percentage may be attributed to the fact that both continents have many countries that are largely agrarian economies. These economies may also depend largely on export of agricultural produce or for own domestic consumption → Thus high percentage of water withdrawal via agriculture Europe and America highest withdrawal from industries as these economies are industrialised economies that depend highly on manufacturing → Therefore water use for industries tend to be very high	

For municipalities, they took up the lowest ration of withdrawal for all regions but tends to be higher for more developed regions such as Europe and Oceania. For the Americas it is skewed as it not only includes the more developed regions such as USA and Canada but also poorer regions such as Mexico and Ecuador. Reasons for higher municipal withdrawal for more developed regions compared to poorer regions attributed to availability and ability to afford to pay for water. In less developed regions, due to high cost, poor people will have to ration their water use and conserve every drop they have. Likely for them to reuse water as well due to also difficulty of obtaining water for use. High cost may also be from local people selling water at high price to these people who do not have access to piped water.

Level	Marks	Descriptors
3	7-8	Clear focus of question with use of relevant knowledge and examples in the response.
2	4-6	Response provides some analysis and evaluation. Most terms are accurately used. Generally well organised and structured.
1	1-3	Response is brief and fragmentary and lacks clarity.
0	0	No Creditworthy response

(d)	With reference to Resource 3, briefly explain the transboundary nature of the Mekong river.	[2]
	- The Mekong river flows through 6 countries, starting from China, entering along Laos and Myanmar and along the northern parts of Thailand, entering Cambodia and finally emptying into Vietnam.	
(e)	Using Resources 3,4 and your own knowledge, examine the nature of issues relating to transboundary water use.	[9]
	Indicative content Nature of issues relating to transboundary water use can be classified into 3 aspects: - Quality (Environmental access to clean water) - Quantity (Competing claims for limited supply of water) - Timing (Building of dams)	

According to Resource 4, the nature of issues relating to transboundary issues relating to water use may be relating to access to the water due to population growth. In the resource, it can be seen that various countries along the Mekong river has seen tremendous population growth from 1990 to 2018. Thailand's population has grown by 11.1 million, Cambodia by 7.3 million, Laos by 2.7 million and Vietnam by 30.5 million. As such quantity may be an important issue in the competing use of water.

Secondly timing may also be an issue in Transboundary water conflicts. Dam building in this case the Xiaowan Dam in China and several dams along the Mekong river to either capture water for water use or generation of electricity for the growing population could also be an issue. The building of dams affect fisheries as spawning grounds are flooded and can no longer be reached. In addition, the trapping of sediments behind dams can also affect the viability of agriculture downstream as fertile sediments can no longer reach the delta. The issue is also further complicated by control of waters upstream as seasonal fluctuations in river is disrupted. (Flooding can take place when water is suddenly released downstream and cause flooding in the downstream states) [** Students can also use other case studies to bring up issue of timing]

Lastly the nature of issues relating to transboundary water use can also be related to quality. Environmental pollution released by agricultural seepage in the upstream states as in the case of Colorado river severely degrades the water quality making it unusable by the time it reaches Mexico. Furthermore, the problem is worsened when dams were built upstream and siphoning water from Mexican delta. The result is decreased volume in flushing out pollutants. In the case of Mekong river, blasting of rocks to improve navigational safety can also cause sedimentation and severely degrading water quality in the Mekong river.

As such, issues relating to transboundary nature of water issues are often multi-faceted and may involve more than one reason in determining the nature of the conflict.

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(a)	With reference to Resource 1, describe the trend of the amount and share of electricity produced from nuclear sources in the world from 1990-2013.		[4]
	From 1990 to 2013, there has been a decrease in % of world total share of electricity from nuclear sources. It was 17% in 1990 and 11% in 2013. [1] There has been an inverse relationship between decrease in % of world total and total amount of electricity. There has been an increase in total amount of energy from nuclear energy, the amount increased from 1900 Twh to 2600 Twh in 2010 [1], from 2010-2013, there is a slight decrease to 2300 Twh. [1]		
(b)	With reference to Resource 2, describe the generating capacity of nuclear power plants (In Operation and Under Construction & Planning) in major countries.		[5]
	- In terms of in operation capacity of nuclear power plant, the highest 3 countries are DC, they are USA with 10,267.7, France and Japan. - The lowest three in operation are UK, India and Brazil. (Cite resources) In terms of under construction and planning, the highest is China with 6076.2 and Russia with 2761.2, these are the NIEs. - The lowest under construction would be Brazil, France & UK (cite) - In terms of world total operation 392,226 is in operation and under construction and planning it is 200,810 MV).		
(c)	With reference to Resource 2, discuss the implications of nuclear power plants plans in the major countries.		[5]
	Positive - Supposedly a cleaner source of energy as it does not produce carbon dioxide. Negative - Potential health risk of radiation exposure in case of leakages.		

		• Radioactive waste disposal needs to be carefully managed and could cause health and environmental problems (contamination of water). • Nuclear energy requites uranium as a fuel and this contributes to release of carbon dioxide • Costly on government revenue	
(d)		With reference to Resource 3, compare and contrast the total investment in clean energy of China and the EU.	[6]
		Similarities • % of GDP in 2010 total investment in clean energy is the same in 2010 at 0.7% of GDP. • Total investment in clean energy in terms of per capita, both the EU and China have the same amount in 2015. (cite value) Differences • EU has higher per capita investment in the year 2005. (Cite value) • % of GDP China has higher figures than the EU from 2005-2015. (cite value) • For the EU, total investment level is higher from 2005-2012 but from 2013 onwards, China has greater investment levels. (cite value) • China increase energy sees an increase, EU increases to 2011 and then decreases. China sees a steadily increase of investments whereas EU sees an increase follow by a decrease.	
(e)		With reference to all the resources, assess China's contribution to sustainable development.	[7]
		Resource 2, China is planning more nuclear plants and is currently the 6th highest in operation. Hence it contribution to nuclear energy is of great influence. The aggressive plans could be that China is the world's largest population and industries, their shift to nuclear energy might be less environmentally taxing in carbon dioxide emission since currently China is using a lot of unrenewable resources such as coal. However, the impact of nuclear energy could be very good. Given the health risk, these might not be environmentally and socially sustainable. Nuclear energy is not sustainable as uranium fuel is finite. Nuclear power is not carbon free. It requires water to cool superheated ones and potential for water pollution is high. In terms of economic sustainability, nuclear energy takes a huge contribution of the China's GDP, this could involve high government	

subsidy and taxes which could be used for other energy investment such as solar and wind power or other social spending areas. This might not be economically sustainable.

Nuclear power plant generates more electricity to conventional power plants that run on fossil fuels, hence given China's population size and industrial needs, the government might have felt that it is more efficient to use nuclear power plants.

Nuclear power plant could create potential jobs for peoples (short term economic sustainability) but in the long term social impacts might outweigh the short term gains.

Potential solar and wind energy for provision for electricity but doesn't seem to looking this areas as much as nuclear energy. These sources tend to be less toxic compared to nuclear energy and are also renewable.

China has been looking at HEP but there is environmental damage and transborder conflict as well. Such as the Mekong river involvement.