ASRJC 2023 JC1 H1 GEOGRAPHY MYCT
ANSWER GUIDE

Cluster 1: Sustainable Future and Climate Change

1 Resource 1 shows the percentage of the total population that lives in urban areas for selected world regions from 1990 to 2050 (projected). Resource 2 shows the ecological footprints of Athens, Greece, and Cairo, Egypt. Resource 3 is a cross section of a home in Beddington Zero Energy Development (BedZED) to show water and power systems. BedZED is the UK's largest sustainable urban development and was designed to be carbon neutral.

(a) Using Resource 1, describe the variations in growth of urban populations in the world regions between 1990 and 2050. [4]

Possible responses:

- Overall increase in the percentages of total population living in urban areas for all world regions between 1990 and 2050.
- However, there are differences in the rate of increase between more developed vs less developed regions:
    - More developed regions such as Europe and North America increased at a slower rate from 1990 to 2018 and also expected to be so from 2018 to 2050
        - For example, the percentage of total population living in urban areas in Europe increased by 4% from 1990 to 2018 and is expected to increase by 10% from 2018 to 2050.
        - The percentage of total population living in urban areas in North America is expected to see a consistent increase of 7% from 1990 to 2018 and from 2018 to 2050.
    - This is in contrast to less developed regions like Africa and Asia which increased at a faster ratE.
        - For example, the percentage of total population living in urban areas in Africa increased by 11% from 1990 to 2018 and is expected to increase by 16% from 2018 to 2050.
        - The percentage of total population living in urban areas in Asia increased by 18% from 1990 to 2018, and is expected to increase by 16% from 2018 to 2050.

(b) Suggest reasons for the variations in growth of urban populations in the world regions as seen in Resource 1. [4]

Possible responses:

- Trend of counter-urbanisation and lower rates of natural increase in developed regions
    - Reasons for counter-urbanisation:
        - Changing residential preferences amongst people due to people's perceptions of the differences in quality of life between large cities and smaller towns and villages;
        - Improvements in health, education, and social services in some rural areas.
        - ***[Facilitating factor]*** Improvements in transport, especially the construction of new motorways, and/or rail routes that enable longer-distance commuting;
        - ***[Facilitating factor]*** Improvements in information and communications technology such as e-mail and video-conferencing facilities
    - Reasons for lower rates of natural increase:
        - Changing perceptions of children and lifestyle aspirations

- Women living in developed regions typically have greater access to education and modern methods of family planning

- Trend of rural-urban migration and higher rates of natural increase in less developed regions
  - Reasons for rural-urban migration:
    - Perceived access to greater employment opportunities in urban areas;
    - Perceived access to higher standards of sanitation and healthcare in urban areas;
    - Perceived access to higher quality of education in urban areas; etc.
  - Reasons for higher rates of natural increase:
    - Migrants are often younger, on average, compared to the populations living in areas of origin or destination. This can also contribute to natural increase of the urban population in the receiving region since a younger population has a greater potential to have child, and thus contribute to the population momentum for growth.

(c) Explain how the concept of ecological footprint can help to measure sustainability. [4]

Possible responses:

- EFA is a **quantitative assessment of all the biophysical resources needed to support the consumption** by particular groups of people (e.g. a country or city).
- The Ecological Footprint (EF) is typically expressed in terms of global hectares (gha) of biologically productive area (of world average productivity) that are required to support that activity. Specifically, it takes into consideration:
  - The population's ***demand (footprint)*** for natural resources. i.e. the **ecological assets that a given population requires** to **produce** the natural resources it consumes (including plant-based food and fiber products, livestock and fish products, timber and other forest products, space for urban infrastructure) and to **absorb its waste.**
  - The **supply (biocapacity) of resources** that nature (or a given area) can provide. On the supply side, a city, state or nation's biocapacity represents the productivity of its ecological assets (including cropland, grazing land, forest land, fishing grounds, and built-up land). These areas, especially if left unharvested, can also absorb much of the waste we generate, especially our carbon emissions.
- The sustainability of a country/ city can be assessed by **looking at the relationship between these 2 components**:
  - If a population's Ecological Footprint exceeds the region's biocapacity, that region runs an ecological deficit, and is considered to be less sustainable. [1m] In such a situation, the overexploitation of natural resources could lead to environmental damage in the short-term, and longer-term impacts such as biodiversity loss, which could then undermine intergenerational equity and affects progress towards sustainability.
  - If a region's biocapacity exceeds its Ecological Footprint, it has an ecological reserve and is considered to be more sustainable. [1m] In such a situation, ecological assets are more likely to be available for use by future generations, thus ensuring intergenerational equity and progress towards sustainability.

(d) Using Resource 2, compare the components of the ecological footprint of Athens, Greece with those of Cairo, Egypt. [4]

Possible responses:

Athens	Similarity/ Difference	Cairo
	Greatest component of EF: Both cities are similar in terms of the greatest component of EF. Food is the greatest component of EF for both Athens and Cairo, at 31% and 36% respectively.	
	Smallest component of EF: Both cities are similar in terms of the smallest component of EF. Government is the smallest component of EF for both Athens and Cairo, at 4% and 7% respectively.	
Housing makes up only 7%, while services only make up 5%.	**Significant difference in contribution by housing and services**	Contribution by both housing and services is almost double that of Athens – housing is at 13%, while services is 9%.

(e) With reference to Resource 3, explain why living in BedZED could be environmentally sustainable. [6]

Possible responses:

- Solar panels on roof to provide electricity:
  - This is more environmentally sustainable as it reduces the use of fossil fuels which leads to carbon emissions, contributing to global warming.
- Rainwater collection for consumption (such as to flush toilets):
  - This is more environmentally sustainable as it reduces the need to tap on main water resources and minimises wastage from rainwater simply flowing away.
- Use of biofuels to create electricity and heat water:
  - This is more environmentally sustainable as it reduces the need to tap on new energy resources or fossil fuels to generate electricity or heat. [1m] It also reduces the volume of waste since it taps on dead branches and leaves, which contributes to a more circular urban metabolism which is more environmentally sustainable.
- Use of low flush toilet/ lower energy lighting and appliances/ electric cars
  - This is more environmentally sustainable as these reduce consumption of water and energy resources which contributes to intergenerational equity in the long-term since less resources are used currently.
  - The use of electric cars also reduces use of fossil fuels which leads to carbon emissions, contributing to global warming.

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2 Resource 4 shows waste generation per capita and urbanisation rate of various regions in the world. Resource 5 shows plastic waste management in the USA from 1960 to 2015 (thousand tonnes). Resource 6 is an article on recycling in Canada.

(a) With reference to Resource 4, describe the differences in waste generation between Sub-Saharan Africa and North America. [4]

Answer Guide:

Sub-Saharan Africa	Basis of comparison	North America
Lower volume of waste generated per capita per day – 0.5 kg/capita/day	Volume of waste generated per capita per day	Higher volume of waste generated per capita per day – 2.2 kg/capita/day
Lower total volume of waste generated annually – 174 million tonnes per year	Total volume of waste generated annually	Higher total volume of waste generated annually – 289 million tonnes per year

(b) Suggest reasons for the difference in waste generation per capita between Sub-Saharan Africa and North America as seen in Resource 4. [4]

Answer Guide:

- From Resource 4, it can be seen that there is a higher urbanisation rate in North America (85%) as compared to Sub-Saharan Africa (38%).
- Difference in level of development – There is a higher level of development
    - Difference in disposable income – In North America, residents tend of have higher disposable income and hence would have higher consumption levels as compared to residents in Sub-Saharan Africa. With increased purchase of goods, there would be more packaging and other waste products generated. This would cause per capita waste generation in North America to be significantly higher than in Sub-Saharan Africa as
    - Difference in lifestyles – In North America, where the level of development is higher as compared to Sub-Saharan Africa, there is a stronger emphasis on convenience. This means that more people would be (i) willing to purchase pre-packaged goods which generate waste for the sake of convenience, and (ii) would be more willing to throw away items as waste rather than repurposing them if it would increase convenience. This would increase waste generation per capita generation in North America as compared to Sub-Saharan Africa.

(c) Describe the trends in plastic waste management in the USA from 1960 to 2015, as seen in Resource 5. [4]

Answer Guide:

- In general, all three plastic waste management strategies experienced an increase from 1960 to 2015.
    - Landfills: Increased from 100 thousand tonnes in 1960 to 26,010 thousand tonnes in 2015.
    - Combustion with energy recovery: Increased from 50 thousand tonnes in 1980 to 5350 thousand tonnes in 2015.
    - Recycling: Increased from 80 thousand tonnes in 1960 to 3140 thousand tonnes in 2015.
- However, recycling and combustion with energy recovery started much later than

landfills – landfills started in 1960, but combustion with energy recovery started only in 1980 and recycling only in 1990.

- Landfills still remain the most common plastic waste management strategy from 1960 to 2015, accounting for the majority of plastic waste being managed from 1960 to 2015.

(d) Explain why incineration is a common waste management strategy in cities. [4]

Answer Guide:

- Incineration is a common waste management strategy in cities as it provides benefits to cities beyond waste management.
    - Energy recovery: Incineration plants can generate electricity and heat that can substitute power plants powered by other fuels at the regional electric and district heating grid, and provide steam supply for industries.
    - Conversion of ash into stones: One form of treatment developed in Japan is to convert incinerated waste ash into melted slag, which is then artificially crystallised to form stones. The stones can then be used in civil engineering works (e.g. as building materials).

(e) With reference to Resource 6, explain why recycling may be limited in effectiveness to manage waste in Canada. [6]

Answer Guide:

Challenge	Why the challenge might cause recycling to be limited in effectiveness	Evidence from Resource 6
Economic challenge: Recycling is too expensive	High cost presents a disincentive for recycling. As few people recycle, recycling extent is low, and hence may be too small-scale to be effective in managing waste.	"Low oil prices make it difficult for plastic recyclers, who must invest in expensive sorting and processing facilities, to compete against already established petrochemical manufacturers. It's cheaper to make plastic from so-called "virgin oil" and put the waste in landfills than it is to recycle old plastics into new products."
Technological challenge: Sorting and recycling of waste is difficult	Issues of contamination and technology for sorting and recycling of waste not being efficient enough to sort through a variety of materials means that only a low volume of waste is recycled, and therefore cannot help in managing large volumes of waste generated.	"Recycled plastic production is also hindered by available technology. For recycling to be effective, the stream of plastics entering the recycling facility needs to be clean and well sorted — a requirement that is difficult to meet. There is also a large variety of plastics, and these are also incorporated into different parts of the same consumer product, which makes sorting difficult or impossible."
Social challenge: Main cause of	Root cause of problem is not individuals, as businesses/ institutions generate greater	"In addition, the majority of plastic waste in Canada comes from businesses, institutions

waste generation not addressed by recycling efforts	volume of waste. Hence, their waste is not recycled, recycling cannot help in managing large volume of waste generated anyway, rendering it limited in effectiveness.	and industry, yet most regional waste management schemes focus on collecting and recycling plastic waste from homes. “